

ASSESSMENT REPORT OF THE CNRS
(CENTRE NATIONAL
DE LA RECHERCHE SCIENTIFIQUE)

November 2023

On behalf of the committee of experts¹:

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On behalf of Hcéres²:

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Under the decree n° 2021-1536 of November 29, 2021:

¹ the assessment reports "are signed by the chairperson of the committee of experts" (article 13);

² the president of Hcéres "countersigns the assessment reports set up by the committees of experts" (article 8, paragraph 8).

Executive summary

The *Centre national de la recherche scientifique* (CNRS) is a public scientific and technological institution under the supervision of the minister in charge of research. Its main missions, defined by decree, are i) to carry out, alone or with its partners, all research of interest to the advancement of science and the economic, social, and cultural progress of the nation; ii) to contribute to the application and use of the results of this research; iii) to develop scientific information and access to research work and data, by promoting the use of the French language; (iv) to contribute to training in and through research.

The CNRS covers all fields of science. It is organized into ten scientific Institutes. It had a total budget of €3.7 billion in 2021, €2.8 billion (76%) of which came from public subsidies allocated by the French national government, and €0.9 billion (24%) of which came from own-source revenue. The staff represented 31,876 FTE (full-time equivalent), including 23,873 FTE permanent staff and 8,003 non-permanent staff.

The CNRS research activities are organized into more than 1,000 research units (or laboratories), which are almost always shared with other institutions, mainly universities or other national research organizations and “*grandes écoles*”. They are called “joint research units” (in French “*unités mixtes de recherche*” or “UMRs”). There are 109,800 persons in CNRS UMRs, i.e. over 40% of the total workforce of the French public research ecosystem; 27% of them are CNRS employees. The CNRS UMRs are spread among more than 80 cities in France.

* * *

The international assessment committee was tasked by the High Council for evaluation of research and higher education (Hcéres) with conducting an external assessment of the CNRS for the 2017-2021 period. The committee consisted of scientists and leaders from the worlds of universities, research organizations, technology transfer organizations, and business and industry. The review was concerned with the CNRS in its entirety as well as its interplay with the French research and higher education eco system, but not with a detailed review of the constituent Institutes or of particular scientific disciplines.

The assessment process entailed a review of a self-assessment report that was prepared by CNRS leadership, and a succession of committee meetings prior to a week-long in-person review that occurred May 8-12, 2023. The agenda for the in-person visit included extensive discussions with CNRS leadership, including for each of the 10 constituent Institutes, visits to university sites and UMRs, on-site meetings with junior and senior scientists and support staff, and meetings with CNRS partners – universities, corporations and French and European national research organizations. More details on the agenda of the visit are provided at the end of the report. The committee is very grateful for the support it received from Hcéres and from the CNRS teams over the course of the review.

* * *

The main features of the assessment report can be summarized as follows:

1. Overall assessment. While the committee did not conduct an in-depth review of the work being done within and across the constituent Institutes and their research units, it considers that the overall scientific output of the CNRS is strong: the scientific production from the UMRs has a worldwide recognition and, in each field of science, some UMRs' teams are among the world leaders in the field. However, the performance metrics that were described to the committee tended to focus on inputs (number of people hired into cross-disciplinary projects, for example) rather than outputs. The CNRS system would benefit from regular international expert reviews of the Institutes – and of cross-cutting programs and initiatives, demonstrating impact on key societal challenges. Tools to monitor research excellence and impact that are both accurate and legible to the international scientific community should be developed, as well as a stronger culture of international assessment and benchmarking. The committee also recommends that the CNRS clarify and strengthen its scientific policy and its partnership strategy (see Chapter V).
2. Missions and role of the CNRS in France. The CNRS plays a key role in the French research and higher education ecosystem. It is in a unique position to play a leading role in French research, as it did for instance in recent years for the development of open science. Since the 1960s it has had a critical and positive influence on the research performed at the universities and *grandes écoles*. However, the situation has deeply changed in the last decades, and it is evolving fast in the context of the development of French universities. There is a need to reposition and clarify the CNRS role and responsibility in this changing context. Also there seems to be some tension between the CNRS strategy and those of other national organizations (e.g. Inria, Inserm); there is apparently a lack of overall coordination that would engage the various stakeholders (see Chapter I).

3. Universities. The relationship between the CNRS and French universities is both complex and evolving. The goal of hitting the "sweet spot" where scientific opportunities, research instruments and methods and a multi-generational mix of passionate people all come together in an efficient setup remains a work in progress. The committee gives several recommendations for a deepened and more complete partnership between the CNRS and the universities, including in particular, improved governance and "co-management" of UMRs and an increased contribution of CNRS researchers to educational activities (see Chapter IV).
4. Talent. The committee observed that there is considerable pride in being associated with the CNRS brand. However, it finds that workforce development is an underappreciated but important element of the national impact of the CNRS that warrants additional attention. The committee did not see evidence of a structured talent plan or a structured career mentoring system. This is out of step with common practice elsewhere. There is no mandatory training on HR (human resources) related skills on any level. This is also out of step with common practice elsewhere. The CNRS would benefit from establishing a more robust culture of meaningful and constructive support for the development of its scientists and employees, including through annual feedback. This would also help address the challenge of dealing with underperforming staff. The continued deterioration of competitive compensation levels for engineers, technical, administrative, and research staff poses a risk to maintaining the level of excellence of CNRS. Also, the bi-directional flow of people between the CNRS and the private sector is an important element of knowledge and technology transfer. The assessment committee considers that recruiting and retaining the best talent, at all levels and in all activities, is the primary challenge for the CNRS (see Chapter III).
5. Administrative processes. The administrative burden is too heavy at all levels. Moreover, CNRS upper management seems to not fully appreciate the deep level of frustration across the system. There is a stark contrast between the efforts made to increase agility in technology transfer vs. the apparent lack of urgency in addressing administrative inefficiency. Administrative staff members are under growing pressure due to lack of resources, the complexity of procedures, and high turnover. In many research units, insufficient administrative and technical support paired with dysfunctional administrative structures hinders everyday work and poses a long-term risk to the system (see Chapter IV).
6. Governance. The committee noted that the CNRS Board of directors is not playing its strategic role. The committee emphasizes that it is of the utmost importance that the Board fully plays its role and establishes a clear strategic agenda. Also, the distribution of key responsibilities and the main decision-making processes within the CNRS are not clear: there is very little transparency on how and where key decisions are prepared and made, and a lack of clarity on the strategic directions and the criteria that these decisions are based upon. The committee does appreciate that the CNRS leadership is balancing tensions between a bottom-up and top-down approach to scientific leadership and management, but it finds that a reconsideration of the various organizational roles and relationships, and communication channels, is needed (see Chapter II).
7. Engagement in society. The committee considers that the CNRS should strengthen its contribution to the development of a well-educated society through the dissemination of knowledge, and increase the level of its communication both with the public at large and with the government. Reinforcing research and leveraging expertise on the main societal themes chosen as CNRS priorities is an opportunity for this stronger engagement (see Chapter VIII).
8. Innovation and technology transfer. There is evidence of significant progress in engagement and relations with the private sector. The efforts made to develop technology transfer through professional support, skills, and accessible staff, are commendable. Many initiatives have been undertaken to support innovation and technology transfer. These efforts are to be pursued and strengthened, and their impact will need to be assessed. Although researchers are encouraged to conduct innovation and entrepreneurial activities, this is often not recognized in their assessment and promotion, and the CNRS needs to overcome this difficulty. In addition, social innovation is not currently recognized at the same level as technology transfer (see Chapter VI).
9. European commitment. Thanks to its size and the breadth of its expertise in all scientific fields, the CNRS is in a unique position to propose ambitious programs that contribute to the success and influence of European science and innovation. It should define ambitious and disruptive initiatives associating the best European institutions, and increase its participation in EU research and innovation programs (see Chapter VII).

The assessment committee identified 12 main recommendations, intended to help the CNRS to achieve its full potential, for the benefit of the French and global scientific community, and society as a whole (see page 5). It also identified the main strengths and weaknesses of the CNRS (see the conclusion of this report).

Main recommendations

The analyses of the assessment committee have led to the main recommendations listed below, which are described in greater detail in the body of the report. While recognizing the quality of the CNRS, these recommendations are intended to enable the CNRS to achieve its full potential, for the benefit of the French and global scientific community and society as a whole.

These recommendations are mainly addressed to the CNRS. Some of them are also addressed to the Ministry of higher education and research for the purposes of preparing the contract between the CNRS and the French national government for the 2024-2028 period.

The main recommendations are listed below in the order in which they appear in the report.

Recommendation 1	Update the role and positioning of the CNRS within the evolving French research ecosystem
Recommendation 2	Modernize the governance of the CNRS and bring it to the level of other world-class research institutions
Recommendation 3	Deploy new strategies for sustained multiannual diversified funding
Recommendation 4	Implement an ambitious strategy to attract, support and retain the best talent
Recommendation 5	Develop a culture of mentoring and inclusion at all levels
Recommendation 6	Deepen the partnership with universities, strengthen the co-management of the UMRs and the involvement of CNRS researchers in education
Recommendation 7	Launch a “commando operation” to respond urgently and decisively to the need to simplify administrative processes and reduce the bureaucratic burden on the CNRS community
Recommendation 8	Strengthen the scientific policy and the partnership strategy, as well as risk taking, and implement regular international expert reviews and benchmarking
Recommendation 9	Accelerate the development of innovation and transfer to society
Recommendation 10	Act as a driving force and source of proposals at the European level
Recommendation 11	Encourage a culture of sustainability, integrity and responsible research
Recommendation 12	Enhance knowledge sharing and communication for the benefit of society

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Introduction

1 / Composition of the assessment committee

The assessment committee included 16 experts of 10 different nationalities (in terms of citizenship or residence):

- Martin Vetterli, president of the *École Polytechnique Fédérale de Lausanne* (EPFL, Switzerland), chair of the assessment committee;
- Sophie D'Amours, rector of *Université Laval* in Quebec (Canada), vice-chair of the assessment committee;
- Michael Bronstein, DeepMind professor of artificial intelligence, University of Oxford (UK);
- Lorraine Daston, director emerita, Max Planck Institute for the history of science in Berlin (Germany), and Committee on social thought, University of Chicago (USA);
- Jo De Boeck, executive vice-president and chief strategy officer, Imec (Leuven, Belgium);
- Sandra Díaz, professor of ecology, National University of Córdoba and senior member of CONICET (Argentina);
- Jérôme Faist, professor of physics, Swiss Federal institute of technology in Zürich (ETHZ, Switzerland);
- Timothy Gowers, *professeur titulaire* of the Combinatorics chair at *Collège de France*, and fellow of Trinity College, University of Cambridge (UK);
- Hervé Guillou, former chairman and chief executive officer of Naval Group;
- Regine Kahmann, director emerita, Max Planck Institute for terrestrial microbiology (Marburg, Germany);
- Ilan Marek, distinguished professor of chemistry, Technion (Israel Institute of technology, Haifa, Israel);
- Friederike Otto, senior lecturer, Grantham Institute for climate change and the Environment, Imperial College, London (UK);
- Riccardo Pozzo, professor of philosophy, Tor Vergata University of Rome (Italy);
- Richard Riman, professor of material sciences and engineering, Rutgers University (USA);
- Chiara Sabatti, professor of biomedical data science and statistics, Stanford University (USA);
- Christopher Stubbs, professor of physics and astronomy, dean of science, Harvard University (USA).

Jean-François Ricci (EPFL) contributed to the committee's work as "*chargé de mission* to the chairman".

A brief biography of each expert is given at the end of this report.

2 / Presentation of the CNRS

Created in 1939, the *Centre national de la recherche scientifique* (CNRS) is a public scientific and technological establishment (EPST) under the supervision of the minister in charge of research. Its missions, set out by decree no. 82-993 in 1982 and amended by decree no. 2015-1151 in 2015, are to:

- identify, carry out, or have carried out, alone or with its partners, all research of interest to the advancement of science and the economic, social, and cultural progress of the nation;
- contribute to the application and use of the results of this research;
- develop scientific information and access to research work and data, by promoting the use of the French language;
- contribute to training in and through research;
- participate in the analysis of the national and international scientific situation and its prospects for development as a contribution to drawing up the national policy in this field;
- carry out evaluations and expert assessments on scientific questions.

The CNRS covers all fields of science. It is organized into ten scientific Institutes:

- National Institute of nuclear physics and particle physics (IN2P3);
- Institute of chemistry (INC);
- Institute of ecology and Environment (INEE);
- Institute of physics (INP);
- Institute for information sciences and their interactions (INS2I);
- Institute of biological sciences (INSB);
- Institute for humanities and social sciences (INSHS);
- Institute for engineering and systems sciences (INSIS);
- National Institute for mathematical sciences and their interactions (INSMI);
- National Institute for Earth and space sciences (INSU).

The CNRS is governed by a Board of Directors (BoD) made up of elected staff representatives, appointed individuals and representatives of the national government; the chairman of the BoD is the chief executive

officer (CEO). The CNRS and each of the ten Institutes also have a Scientific Board.¹ In addition to the CEO, the Executive committee includes the three deputy CEOs, who are respectively in charge of science, resources and innovation, the directors of the ten Institutes and the director of the communication department, as well as the CEO's chief of staff.

The CNRS had a total budget of €3.7 billion in 2021. This budget included €2.8 billion (76%) in public subsidies allocated by the national government, and €0.9 billion (24%) in own-source revenue. In 2021, about 72% of CNRS expenditures were devoted to staff salaries. The staff represented 31,876 FTE (full-time equivalent), including 23,873 FTE permanent staff and 8,003 non-permanent staff. In detail, the permanent staff included 11,076 permanent researchers (*chargés de recherche* and *directeurs de recherche*) and 12,797 permanent engineers, technicians, and administrative employees.

The CNRS conducts its research in partnership with a wide range of actors, the majority of which are universities and other French national research organizations and *grandes écoles*. **Research is performed in more than 1,000 units (laboratories), almost all of which are shared with other institutions.** They are known as "joint research units" (in French "*unités mixtes de recherche*" or "UMRs"). Typically, a UMR can be thought of as a research lab shared between two "home institutions", the CNRS and a university; a UMR is a shared internal entity (with no legal personality) that appears in the organizational chart of each of the two institutions. However, some UMRs (41%) have more than two home institutions. According to its self-assessment report, the CNRS has 865 research units, 97% of which are joint research units; it also has 201 "support and research units" (in French "*unités d'appui et de recherche*", UARs), 74% of which are joint units with other institutions.²

CNRS UMRs employed 109,800 persons in 2021, i.e. over 40% of the total workforce in the French public research ecosystem. Of these 109,800 persons, 29,600 (27%) are CNRS employees. However, the weight of the CNRS in this workforce is quite different depending on the type of personnel assigned to the UMRs. **The CNRS employees represent:**

- **24% of the permanent scientific staff of the UMRs** (45,600 persons, including CNRS researchers, university professors, etc.);
- **48% of the permanent "support" staff of the UMRs** (22,300 persons, including engineers, technicians, and administrative staff from the CNRS, universities and other institutions);
- **19% of the non-permanent staff of the UMRs** (41,900 persons, including PhD students, post-doctoral researchers, etc.).

CNRS UMRs are located in over 80 cities in France. The CNRS has 18 regional offices that are responsible for direct local management of research units and for liaising with local partners and authorities.

3 / Context of the assessment

a/ Main elements of context

This is the very first assessment of the CNRS organized by Hcéres,³ which therefore chose to hold in-depth discussions with CNRS senior management beforehand. The Hcéres *Reference assessment framework for national organizations* approved in October 2021 by its Board establishes the principle that the assessment of each national research organization is tailored to its missions, its situation, and the key issues at stake in its fields of action. This adaptation is all the more important and necessary for the CNRS, given its very large size and the very large size of the set of its UMRs.

On the basis of the discussions held in late 2021 and early 2022, and the expectations expressed by the supervisory ministry, the Ministry of higher education, research and innovation, in a meeting of Hcéres with the General director of research and innovation, Hcéres has chosen to focus the assessment on key topics selected in the *Reference assessment framework*. This selection was made in agreement with CNRS senior management, the aim being to ensure the feasibility, relevance and usefulness of the assessment for the CNRS and the ministry. In particular, this means that certain CNRS activities are not examined in this assessment, despite their importance: this is the case for the CNRS policy concerning very large research instruments, its international partnerships outside Europe, and most of the themes related to support functions.

¹ Moreover, there exist 41 sections and 6 interdisciplinary commissions that are mainly in charge of assessing the activities of permanent CNRS researchers, forming the eligibility jury for the recruitment of permanent researchers, and giving an advice on the creation, renewal or shutdown of research units. The Scientific Board, the 10 Institute's Scientific Boards, the 41 sections and the 6 interdisciplinary commissions make up the "National committee for scientific research".

² In this report, all these units are simply called "research units", "CNRS UMRs" or "UMRs" for the sake of simplicity and brevity.

³ More precisely, the CNRS was assessed twice, in 2012 and in 2016, but never with the methodological framework which now exists for the assessment of a national research organization. A first assessment was performed in 2012 by Aéres (the predecessor of Hcéres) at a time where Aéres had no reference assessment framework for national research organizations. A second one was performed in 2016 by a committee of experts chosen by CNRS management and with reference terms set by the CNRS itself. The assessment reports of 2012 and 2016 are publicly available on the Hcéres website.

As a result of this work, the “*Terms of reference for the 2022-2023 assessment of the CNRS*” were written by Hcéres and published on the Hcéres website⁴ in March 2022. They present the topics and criteria for this assessment of the CNRS – or, in mirror form, the elements expected in the CNRS self-assessment report. For some of these topics and criteria, the Terms of reference stipulate that the assessment consists not only in reviewing the CNRS as a whole, but also of paying attention to the specificities of the field of action of each of the ten Institutes. They also stipulate that the reference period for this assessment is 2017-2021.

The Terms of reference also state that the assessment covers the implementation of the CNRS five-year contract of objectives and performance (COP) with the French national government for the 2019-2023 period. They also recall that providing both the CNRS and its supervisory ministry with recommendations for the preparation of the next COP for the 2024-2028 period is one of the assessment's objectives.

On the basis of the Terms of reference, the expectations expressed by the CNRS and by the ministry, and its reading of the self-assessment report, the assessment committee has identified the main issues examined in this report:

- the missions and the role of the CNRS in France;
- the governance and management of the CNRS;
- strategic issues relating to human resources;
- relations with universities;
- research activities and results, the CNRS scientific policy and partnership policy;
- innovation activities and relations with private companies;
- the CNRS commitment in Europe;
- the activities linked to the integration of science into society and the support of society's trust in science.

b/ The CNRS self-assessment report

The self-assessment report (SAR) delivered by the CNRS in January 2023 was the main source of information for the expert committee at the beginning of its work. The main comments of the assessment committee on the SAR are reported below:

- The SAR does not make it easy for a non-French reader to understand the CNRS and its position in the French research and education ecosystem.
- The content of the SAR and its appendices falls short of what was expected by the committee under the Terms of reference. For instance, its content is weak concerning the position of the CNRS in France in the field of each Institute, or its orientations for the coming years.
- The SAR barely touches on the universities as research operators that can have their own research policy and as key partners that provide most of the talent pool for UMRs.
- The presentations and analyses sometimes refer to the scope of the CNRS (and its 30,000 employees in the research units), and sometimes to the scope of all UMRs (and the 110,000 people working in them), but the SAR rarely specifies which of these two scopes is being considered.
- The SAR includes several tables with many figures that are often difficult to understand.
- The SAR contains very limited comparisons with other institutions, and these comparisons do not consider the size of the institutions.
- The SAR does not include any assessment of the impact of the CNRS, whether on science, economy or society. It shows poor ability on the part of the CNRS to identify its major contributions.
- It is not clear how the SAR has been developed, meaning to which extent the CNRS community was involved in its conception.

It is clear, however, that a great deal of work went into collecting the data and writing the SAR and its appendices. The committee thanks the CNRS for this work. It also thanks the CNRS for its written answers to all the written questions asked by the committee for more complete information.

⁴ See <https://bit.ly/2023-terms-of-reference-assessment-CNRS>.

I. Missions and role of the CNRS in France

Recommendation 1: Update the role and positioning of the CNRS within the evolving French research ecosystem

Considering the fast evolution of the French research ecosystem and the key role of the CNRS, there is a need to adapt and update the positioning of the CNRS in relation to other actors.

Sub-recommendations

- 1.1 Reposition the CNRS role and responsibility in today's reality where universities demonstrate strategic autonomy and research strengths.
- 1.2 Clarify the collaboration with other national research organizations and better define the respective roles, interfaces and modes of operation.
- 1.3 Clarify all aspects of the CNRS national responsibilities, including their modes of operation.

The CNRS plays a key role in the French research and higher education landscape. It is by a large margin the biggest player and the one with the widest coverage of scientific fields. This makes it the obvious discussion partner in structuring science, especially when it comes to large-scale initiatives or equipment that may be required to implement national or international strategies. The CNRS is widely recognized as a major player in European and world research.

As the research environment is evolving, the CNRS must continue to adapt its modes of operation to best serve French society. To achieve this, the CNRS should build on its strengths: its attractiveness in recruiting young scientific talent, the intellectual freedom it offers to them, and the very broad topical scientific coverage it achieves. The CNRS should coordinate its efforts with other actors (higher education institutions, national research organizations and industries) and propose joint initiatives to achieve a critical mass in the topics deemed strategically relevant⁵.

1 / Positioning, missions, and role of the CNRS

The CNRS is in a very special position. First, almost all its research units are joint units with other French institutions. Second, the weight of the CNRS in the national research ecosystem – measured by the share of CNRS UMRs' publications in French scientific publications – is close to 43% (see Chapter V). This seems to be a unique situation for a research organization on a global scale. Such a situation does not help the CNRS to be agile and to implement the priorities of its scientific policy. In addition, the assessment committee notes that the positioning of the CNRS is complicated. The CNRS describes itself in its SAR as facing multiple responsibilities: it is a research operator and it also has some coordinating role for French research as a whole, which creates some loyalty dilemma; it is also a “program agency” and an infrastructure agency. The committee considers that such a large and predominant institution should benefit from a clearer positioning and a clarified definition of its role within the French research ecosystem.

French research is administered at the national level by several different organizations, whose activities and responsibilities sometimes overlap, making coordination challenging. The committee noted that the SAR is very silent on the other national research organizations; moreover, it observed difficulties in the relationship of the CNRS with some of these national organizations. The SAR proposes to “refocus the CNRS on fundamental research” and to position the other national research organizations on “more applicative niches”, but this perspective does not seem to have been discussed with the other national organizations, nor does seem to be acceptable to them.⁶ The committee considers that clarification of the roles of the national research organizations, their interfaces and their modes of operation is needed to enable the French research ecosystem to perform more effectively. As international competition in research from both inside and outside the EU (European Union) is growing, it is important for the future of French research that France's national organizations improve their ability to coordinate their actions efficiently and to share ambitious initiatives. The committee recommends that the ministry set up a task force with representatives from national research institutions, universities and *grandes écoles* to build the bases for these clarifications and improvements.

⁵ The question of the French national research strategy was raised in some of the interviews held during the assessment visit. The committee was surprised to hear that the national research strategy is considered to be unclear and that the Strategic research council, at the level of the French government, has not held a meeting since 2017.

⁶ Source: interviews held during the assessment visit.

The core mission of the CNRS could be clarified. The SAR insists that the “raison d’être” of the CNRS is “basic research at the service of society”. However, it is not clear whether this “raison d’être” has been set in any official document approved by the ministry or the CNRS Board of Directors. The committee notes that the main mission defined by the CNRS decree, i.e. to “*carry out all research of interest to the advancement of science and the economic, social and cultural progress of the nation*”, is not limited to fundamental research. Without denying the importance of fundamental research, it considers that the CNRS insistence on an overly focused mission may hinder the development of a culture of innovation and faster transfer to society and industry.

a/ Role of the CNRS Institutes

Three of the 10 CNRS Institutes, namely Nuclear and particle physics, Mathematics, and Earth and space sciences, have been entrusted with national missions by decree, which means that they are responsible for leading and coordinating all French research activity in their field. On the other hand, the 7 other Institutes operate within the framework of the CNRS and its UMRs. The CNRS is questioning the relevance of this distinction between Institutes, and considers that all 10 Institutes could be officially entrusted with national missions and thus become “national Institutes”. This is one of the issues to which the SAR draws the attention of the assessment committee.

The committee notes that the SAR is silent on the fact that “coordinating” and “leading” the research activities have different meanings in different fields, such as in Nuclear and particle physics or in Earth and space sciences⁷ and in many other scientific fields. The SAR is also silent on the fact that other national research institutions exist and play a major role in the field of some of the CNRS Institutes. Last, the 10 CNRS Institutes have very different “weights” in their respective fields within the French research ecosystem (see Appendix). For all these reasons, the assessment committee does not issue a favorable opinion on this suggestion to transform all CNRS Institutes into “national Institutes”.

b/ National responsibilities of the CNRS

More broadly, the utmost clarity is required for any responsibility entrusted to the CNRS at the level of the whole national research community in a given scientific field. Indeed, the CNRS is such a dominant player on the French scientific scene that there is a high risk of conflicts of interests, i.e. a risk of suspicion of a possible bias in favor of its teams. In particular, it is important that the CNRS pays attention to steering the priority research programs and equipment (PEPRs) for the benefit of the entire French scientific community.

2 / The perspective of the development of French universities

Since the 1960s, the CNRS has had a critical and positive influence on the research performed at the universities, and this remains the case today. However, the situation has deeply changed in the last decades.

- On the one hand, the number of university *professeurs* and *maîtres de conférences* has grown much faster than that of the CNRS employees, transforming the balance within the UMRs system. CNRS employees account today for 27% of the UMRs’ workforce.⁸
- On the other hand, the development of French universities is – and has consistently remained since the Law on the autonomy and responsibility of universities in 2007 – a primary objective of the French government’s policy in the field of higher education and research. Many French universities have gone through in-depth transformations over the past 15 years. In addition, the policy of supporting mergers and alliances has led to the creation of research-intensive universities that have become major players at the French, European and international levels.

During this time, it appears that the CNRS has not updated its role and positioning. The SAR is silent on university autonomy, and says very little on universities as research operators that can have their own policy for developing excellent research. The CNRS still considers that “its role [in France] is to support excellence wherever it may be”,⁹ a vision that corresponds to CNRS’s major contribution to the French research ecosystem in the last century, but which needs to be updated in light of the development of French universities. Over the past 15 years, the CNRS has made changes in its partnerships with universities but it has made very few changes to the way it manages UMRs (see Chapter IV).

It is of crucial importance for the CNRS to better account for these on-going transformations: French research universities will continue to improve their ability to develop new excellent research units, and sometimes joint research units with other French, European or international partners. This evolution will certainly open up opportunities and risks for the CNRS. The CNRS should strive to better envision a future for itself in a context in which universities are constantly gaining in autonomy, and becoming more independent and efficient in developing their strategic research focus, engaging in research on an international scale and accessing a variety of opportunities. The CNRS should update its role and modes of operation in this perspective (see Chapter IV).

⁷ The National Institute of nuclear physics and particle physics (IN2P3), in 1971, and the National Institute for the Earth and space sciences (INSU), in 1985, were the first two Institutes entrusted with national missions.

⁸ Source: SAR.

⁹ Source: written answer of the CNRS to a written question of the assessment committee about the autonomy of universities.

II. Governance and management of the CNRS

1 / Governance

Recommendation 2: Modernize the governance of the CNRS and bring it to the level of other world-class research institutions

Given the necessary evolution of the CNRS in France and considering its size and national role, there is a need to clarify its strategic directions and its governance processes, and to develop the principle of subsidiarity in order to bring the CNRS management structure in line with current best practice. This needs to be accompanied by changes in governance and an improved culture of transparency.

Sub-recommendations

- 2.1 Clarify how the Board of Directors can play its strategic role, including approving the directions of CNRS policy, approving the Objectives and performance contract and establishing a 5-year strategic agenda.
- 2.2 Once the board is given a strategic role, separate the positions of chairman of the Board of Directors and chief executive officer of the CNRS.
- 2.3 Redefine and clarify the role of the Scientific Board.
- 2.4 Create a standing external advisory board with a high proportion of members from abroad.
- 2.5 Create for each Institute a specific domain-related external strategic advisory board, with a high proportion of members from abroad.
- 2.6 Clarify the key responsibilities and the key decision-making processes, in particular concerning resource allocation.

Concerning governance, the CNRS has structures in place, but the general observation is that they are not being used properly. An informal network of interactions plays a strong role in strategic decisions. The governance practices do not provide the needed tools to efficiently support the CNRS excellence.

a/ The Board of directors

According to the CNRS decree, the primary role of the Board of Directors (BoD) is the following: *"The board of directors shall, after consulting the scientific board, analyze and determine the main directions of the [CNRS] policy in relation with the cultural, economic, and social needs of the whole nation. It defines the principles governing its relations with socio-economic partners as well as with universities and national, foreign or international bodies involved in its field of activity"*. This is an ambitious and highly strategic role.

The committee asked for details to understand how the BoD fulfills this role. It appears¹⁰ that, in the last five years, there has not been any document approved by the BoD determining the directions of CNRS policy after consultation of the scientific board and based on an analysis of the cultural, economic and social needs of the nation. The interviews of the chairman and other members of the BoD confirmed that the BoD does not truly play a strategic role, and that many decisions are evidently determined in advance.

This situation generates uncertainty about where the general policy of the CNRS is defined, as well as a lack of clarity on its main strategic directions.¹¹ The committee emphasizes that it is of the utmost importance that the BoD fully play a strategic role, as defined in the decree. This shift should be a point of major attention for the ministry in charge of research. In order to make this shift possible, the committee considers that it is necessary to separate the positions of chairman of the BoD and chief executive officer: this separation is in line with best

¹⁰ Source: in its written answer of the CNRS to a written question from the assessment committee, the CNRS gave the agenda of each meeting of the BoD in the last five years, which made it possible for the committee to investigate the BoD's activities in detail.

¹¹ As additional proof that the BoD is not currently playing its strategic role, the committee observed that about 15 major national priority research programs and equipment (PEPRs) were recently launched and steered by the CNRS on the basis of the directions defined in letters sent to the CEO of the CNRS by the administration of the French government, and the committee was surprised to observe that these letters were not even shared with the BoD.

management practice in other countries, and it will allow the chairman to commit to enhancing the strategic role of the Board.

b/ Advisory Boards

The committee observed that the role and authority of the Scientific Board (SB) is unclear and that it does not seem to have an effective communication channel. Moreover, the SB does not seem to get any feedback on its recommendations to the CNRS.¹² The committee recommends clarifying the role of the SB.

In addition, having understood that the SB is part of the "National committee for scientific research" and that it would be very difficult to change the proportion of "internal" and "external" members in the composition of the SB, the assessment committee strongly recommends setting up a standing independent external advisory board with a high proportion of members from abroad, in line with international best practice at world-class research institutions. The mission of this external advisory board would be to provide the CNRS with external advice and suggestions from an international perspective.

In the same spirit, the committee considers that an external advisory board with a high proportion of members from abroad should also be put in place at the level of each of the 10 Institutes.

c/ Executive management and key decision-making processes

The committee noted that the SAR does little to help understand the organizational model and management of the CNRS.

- The committee considers that the organization chart provided by the CNRS does not give a clear understanding of its organization.
- There is no description of key responsibilities and decision-making processes. The interviews held during the assessment visit did confirm that these processes are unclear to many internal actors: there is very little transparency about how and where the main decisions are prepared and made, and a lack of clarity about the strategic directions and criteria on which these decisions are based.

The committee recommends clarifying the distribution of responsibilities within the CNRS and the key decision-making processes, and communicating on these topics. In particular, the CNRS should clarify which decisions are made at the level of the CEO and deputy CEOs (possibly after discussions within the Executive committee), which decisions are made at the level of the 10 Institutes, and which are made at the regional level or at the level of each local site. Also, the committee noted that having the same person acting as both director of an Institute and "site referent director" (SRD) for a university site poses governance challenges and creates possible conflicts of interests.

The committee also recommends clarifying which monitoring activities are carried out by whom within the CNRS: in addition to the indicators set out in the COP, which indicators are monitored by the Executive committee and which activities and results of the 10 Institutes are monitored by the senior CNRS management? And which sites' and UMRs' results are monitored by the Executive committee or at Institutes' level?

All these clarifications should be communicated to the CNRS community through a solid internal communication plan.

d/ Resource allocation

In particular, the preceding observations apply to resource allocation decisions. The strategic directions, and the criteria and processes for preparing and making decisions should be clarified for resource allocation between Institutes and between UMRs.

The SAR describes the weight of the 10 Institutes in terms of permanent staff positions in 2012 and 2020.¹³ It highlights that the relative weights of the Institutes in charge of ecology and Environment, information sciences, engineering and systems, and mathematics and physics have increased slightly over the period, without mentioning if these shifts are the result of a real strategic choice. However, the committee observes that resource shifts between the Institutes over this 8-year period are low. While aware that this is politically difficult, the committee encourages the CNRS to clarify its strategy for the evolution of the Institutes' resources over the next 5 or 10 years, as part of its vision for the evolution of its research activities.

Allocating resources (staff positions and budget) to research units is a key issue, and responsibility for it is entrusted to the Institutes. Most if not all interviews held by the committee on this topic have shown that there is a lack of clarity and transparency about who decides what. It is very difficult for an external observer to understand the governance of the UMR "system" and the processes for resource allocation. The system seems

¹² Source: interviews held during the assessment visit.

¹³ Source: SAR.

to work on the whole, but it is largely based on interpersonal relationships and on the will of individuals to work together and exchange information.

e/ Governance and management of the UMRs

The SAR does not give a clear vision of the role and responsibilities of the CNRS with respect to UMRs: different words are used, such as “supervise”, “lead”, “steer”, “manage”, “coordinate”, and “monitor”, and clarification would be welcome. On the other hand, the governance and management of UMRs should be a key element of the partnership between the CNRS and a partner university, and this also requires clarification and improvement (see Chapter IV).

The SAR contends that an improvement should be made by generalizing the “Dialogue on objectives of resources” (DOR) meetings with the UMRs and their home institutions. DOR meetings are presented as “a tool for strategic discussions between the UMR and its [home institutions] with the aim of sharing reflections and arbitrations on scientific projects, operational needs, and the allocation of resources”.¹⁴

According to the SAR, the CNRS has made it a goal to conduct at least one DOR meeting for each UMR every five years. The committee notes that this goal, though modest, seems to be quite a remote objective for some of the Institutes, in particular for those Institutes with far more than 100 UMRs (see Appendix). It would be useful for the CNRS to pursue its policy of gradually reducing the number of UMRs, with the aim of ensuring that each Institute has a “manageable” set of strong and visible UMRs rather than a very large number of small units.

2 / Funding

Recommendation 3: Deploy new strategies for sustained multiannual diversified funding

National-government funding has to remain the prime financial resource of the CNRS and has to be in line with its mission and position, but this funding is challenged by difficult and fast-changing socio-economic conditions. It is crucial to keep research capacity at the leading edge internationally over the long term by leveraging this substantial public funding and deploying a strategy to further grow diversified sources of funding for the CNRS as a whole, as well as at the Institute, regional, and unit level.

Sub-recommendations

- 3.1 Give the CNRS visibility on the evolution of its multi-year public funding by including in its next contract of objective and performance a commitment on its national-government subsidy
- 3.2 Develop a multi-year funding plan at central level for the CNRS, including diversified sources of funding, and implement and monitor a multi-year diversified financial plan at the Institute, regional, and unit level.
- 3.3 Find mechanisms that allow for more financial flexibility, operational efficiency, and effectiveness, including transforming FTE (full time equivalent)-based budgets into results-oriented budgets.
- 3.4 Together with institutional research partners, establish fair rules for sharing expenses.
- 3.5 Strengthen efforts using the CNRS capacity and potential to raise European funding and build mission-driven programs that attract other (including private) funding sources.

The SAR describes the global evolution of the CNRS budget in the last 10 years as follows: “Between 2012 and 2021, the CNRS lost 4.3% of its staff paid by public service grants (24,685 vs 25,787) while at the same time, the proportion of this grant devoted to personnel expenses rose from 82.2% to 84.1%. Mechanically, the percentage of the grant available for operations and investments decreased by 2%, from 17.4% to 15.4%. This “double penalty” – fewer employees and a smaller operating and investment budget – has obviously reduced the organization’s capacity to develop and implement a real scientific policy.”¹⁵

This evolution of the budget reveals substantial hardship, and a lack of financial sustainability. This issue should be a major topic in the discussion between the CNRS and the ministry in charge of research regarding the development of the next COP for the 2024-2028 period. The committee considers that national-government funding has to be in line with the mission and position of the CNRS in the French research ecosystem. It also

¹⁴ Source: SAR.

¹⁵ Source: SAR.

strongly recommends that multi-year public funding be committed by the government within the COP, to give the CNRS visibility on the evolution of its national-government subsidy.

In the meantime, the solution to the CNRS financial viability issue is not to be expected only from the national government. The committee was surprised to observe that the CNRS has no clear view on long-term financial planning and no strategy to augment its central budget with diversified funding sources. The committee also noted that many UMRs focus on national funding programs (notably because the success rates at the national research agency (ANR) have increased in recent years). They seem less incentivized to secure EU funding or private funding streams. Responding to out-of-the-ordinary calls requires significant effort and support from operational teams, and must go hand in hand with a long-term financial plan that is challenged in its realism and sustainability.

The committee urges the CNRS to establish and implement an ambitious multi-year funding plan at central level that includes diversified sources of funding. It should also implement this plan at all levels of the organization, setting objectives at the central, Institute, regional and research unit levels, and monitor its implementation.

The committee also observed that the CNRS has little flexibility in deploying financial resources; it should find mechanisms for achieving greater financial flexibility, operational efficiency and effectiveness, including transforming FTE (full-time equivalent)-based budgets into results-oriented budgets.

III. Strategic issues relating to human resources

The CNRS employees are its most important asset. Recruiting and retaining the best talent, at all levels and in all activities, should therefore be seen as the major challenge for the institution, in a context where competition to attract the most talented people has become fierce. All over the world and in Europe, institutions are radically changing their approach to attracting younger and younger scientific talent. We are no longer in a period where an institution can consider that it chooses its talents; we are and will increasingly be in a period where talented individuals choose their institution. The CNRS must urgently take stock of this change, and resolutely rise to the challenge.

1 / Talent

Recommendation 4: Implement an ambitious strategy to attract, support and retain the best talent

The excellence of CNRS research depends on its continued capacity to recruit, promote and retain the best talent at all levels, within a context of a highly competitive international research environment. This objective requires the development of a strong policy to support the careers of all permanent staff, and a specific strong policy to support young researchers.

Sub-recommendations

- 4.1 Launch a CNRS Mission on "Talent and the future of the CNRS", covering scientists as well as technical staff and engineers. Bring in the very best experts in the field to draft an ambitious CNRS "talent strategy", with the support of the government.
- 4.2 In addition to the strategy to recruit the best junior and senior researchers worldwide, further develop incentives to retain them over the long term.
- 4.3 Knowing that the age to enter the junior researcher rank at the CNRS is high, consider adapting the framework in order to be able to give earlier access to positions for young researchers.
- 4.4 Use the full potential of the "tenure track à la française".
- 4.5 Knowing that young researchers will be critical to the renewal of the CNRS, develop a strong policy to support and promote them.
- 4.6 Offer attractive welcome packages.
- 4.7 Provide young researchers with clear and accessible information about career progression opportunities.
- 4.8 Make sure that the individual assessment of researchers recognizes and values all their activities in the framework of their missions.
- 4.9 Create transparency and clarity on promotion, mobility, and training opportunities for engineers and administrative, engineer and technical support staff.
- 4.10 Consider cost of living as well as national and international competition to develop a CNRS compensation package that allows recruitment and retention of top talent from every population group.

a/ Recruitment of researchers

One of the attractive features of the CNRS is recruitment of junior researchers (*chargés de recherche*, CRs) into permanent positions right from the start. Every year, almost 30% of the new researchers recruited by the CNRS are not French nationals, which it considers as an important indicator of its attractiveness.¹⁶ There are substantial differences between Institutes, in terms of both the percentage of newly-hired foreign researchers (see Appendix) and the recruitment age (34 on average). While considering that it is essential to offer a real welcome package to new recruits, the CNRS recognizes that it has taken only "a first step" and that the average amount of this package, €10k, "may seem symbolic".

The committee makes the following observations and remarks:

- Currently, only a few CRs are hired through the "ATIP program", a special route that makes it possible for an Institute to participate in the recruitment process and to allocate a substantial welcome

¹⁶ Source: SAR.

package, with a continued support for up to 5 years. However, this program is considered too expensive to be extended to more recruitments.

- While the CNRS offers permanent positions to its junior researchers, the fact that most of these come without a substantial welcome package will diminish their attractiveness, i.e. some top talent will be lost to other countries who have such programs in place.
- The balance in importance between a permanent position and its level of compensation has shifted at the international level, especially in high-tech sectors. The compensation levels for starting CRs and engineers are not competitive by international standards; affordability generates a selective pressure that negatively impacts the diversity of the CNRS workforce, despite the attractiveness of job security.
- Around 3% of the scientists hired into permanent positions are hired at the senior researcher rank (*directeur de recherche*, DR). This ratio of 3% is very low in comparison with other research organizations. The CNRS should think of increasing its recruitment of established researchers that might boost a particular research theme.
- It is not clear how the CNRS will use the new recruitment possibilities of “tenure track à la française” created in the 2020 research law (recruitment on a fixed-term contract with a substantial package for the first few years and with the perspective of recruitment to a permanent *directeur de recherche* position at the end of the contract). The CNRS should use the full potential of these new positions.

b/ Careers, and support to young researchers

Once hired, CRs join an existing team within a UMR in which they are expected to develop their own research theme, obtain external funding and gain international recognition to succeed in the national competition for DR positions. The period between becoming CR and DR is usually greater than 10 years; about 30 % of *chargés de recherche* remain at the CR level. The committee underscores the need to continue developing incentives for the recognition of researchers' achievements. For example, Institutes should be given the flexibility to reward particularly innovative scientific results, grant applications, and success in scientific and social engagement. Moreover, it is crucial to develop an atmosphere where every researcher is recognized for her or his contribution.

This recognition of all contributions and all activities in the individual assessment of researchers is clearly a challenge for the CNRS and the sections of the National committee for scientific research. Greater efforts must be made to fully take into account all the activities included in the spectrum of researchers' missions, from basic research to technology transfer, from contributions to education to bringing knowledge and innovation to society, not to mention management tasks and collective contributions. Also, the work undertaken by the CNRS towards more qualitative evaluation should continue to be pursued, shared with other actors in France and abroad, and assessed.

More broadly, the CNRS seems not to have fully taken the measure of the challenge it has to face in order to retain the most talented people. The quality of an institution is increasingly measured by its capacity to take care of its employees, and to give them tools and abilities to evolve at all stages of their careers. This holds true for all employees, researchers, engineers, and administrative or technical staff. Beyond the development of mentoring (see Section III.2 below), increased efforts should be made to expand the training available, the range of in-house career opportunities, the possibilities of professional mobility, and overall employee awareness of these perspectives. These efforts should also aim to increase the transparency of all HR processes.

Particularly close attention should be paid to young researchers. The committee did not feel that the CNRS pays enough attention to this particular “category” of employees who are essential for the future of the CNRS and who need be supported. At all levels in the organization (senior management, Institutes, UMR directors), the people interviewed by the assessment committee seemed far more concerned with the scientific output of the CNRS than with the welfare of CNRS researchers: there may be a balance to be struck between the two, but it is not clear that it is currently in the right place.

c/ Overall evolution of the CNRS workforce

According to the SAR, the CNRS considers that the ratio of permanent researchers to non-permanent researchers is not satisfactory and does not match international standards,¹⁷ but no indication is given on the possible evolution of this ratio. While fully aware that this is a highly political and very sensitive issue, the committee suggests that further consideration be given to the matter. In an increasingly open and competitive job market for research talents, in the perspective of the evolving French research ecosystem, how should the CNRS project the evolution of its workforce in, say, 10 to 15 years?

¹⁷ Source: SAR.

d/ External mobility

The CNRS seems to have no real policy concerning the external mobility of its employees, be it the mobility of researchers to universities or the mobility of all employees towards other public institutions or private companies. The HR administration of the CNRS monitors the evolution of the "stock" of the CNRS employees on external positions, with little attention to the "flows".¹⁸ In the SAR, the CNRS states that it is willing to improve in this area, "to offer career developments adapted to each individual's personal project" and to make better use of the richness represented by the presence of several hundred CNRS staff in external positions in public or private institutions. The committee welcomes this initiative.

2 / Mentoring and inclusion

Recommendation 5: Develop a culture of mentoring and inclusion at all levels

Strengthening and monitoring the mentoring of CNRS employees is essential in order to recruit, retain and support its scientific, engineering, and administrative staff. It is crucial that individuals feel valued and have opportunities for advancement, and therefore it is essential to make dedicated efforts to define and promote a culture of respect and inclusion at all levels of the organization.

Sub-recommendations

- 5.1 Redouble efforts to improve the gender balance and inclusion at all levels and ensure that workplace dynamics reflect modern expectations of professional and personal conduct.
- 5.2 Appoint a formal mentor for each newly hired employee to establish a long-term advisory relationship.
- 5.3 Establish regular and more effective career advancement advice for all employees.
- 5.4 Create an ombudsperson/whistleblower system in order to identify issues and solve these as early as possible. Develop and apply best practices, and make all members of the community aware of them.
- 5.5 Establish mechanisms to identify situations where professional and personal conduct falls short of expectations, and train managers on how to effectively deal with these situations.
- 5.6 Start an ambitious work-family balance program, including a significant increase in daycare facilities that are accessible to researchers.
- 5.7 Establish a leadership training program for all new *directeurs de recherche* (DRs).
- 5.8 Together with universities and *grandes écoles*, develop and apply best practice to the mentoring and supervision of PhD theses, including raising awareness of scientific and discriminatory biases; consider mandatory mentoring training for individuals who will play a strong role in graduate student advising.
- 5.9 Fully recognize the contribution of junior researchers (*chargés de recherche* and *maîtres de conférences*) to the supervision of PhD students.

a/ Equality, diversity, and inclusion

There has been an increasing effort from the CNRS to keep track of the proportion of women among the CNRS staff at different levels. Close attention is paid to recruitment and promotion of female researchers, and a special effort has also been made to increase the proportion of female UMR directors. These measures have begun to bear fruit, but progress appears to be very slow, and the committee considers that equality awareness and efforts need to be stepped up. The CNRS Executive committee should lead by example: all four members of the senior management team are men, and 9 of the 10 Institutes were headed by men in 2021.¹⁹

While being aware that gathering statistics about the proportion of ethnic minorities is illegal in France, the committee considers that the CNRS should reflect on the opportunities it offers to members of French society with diverse backgrounds. It should think of having policies designed to encourage and support researchers and staff from historically marginalized groups and to increase their representation.

¹⁸ Source: written answer of the CNRS to a written question of the assessment committee.

¹⁹ Source: SAR.

b/ Mentoring

The assessment committee examined the CNRS mentorship program and its implementation. A mentor is appointed for every newly hired *chargé de recherche* (CR), but mentoring is limited to the very first years of the career. At least in some of the Institutes, there is an on-boarding program for new CRs; these programs are very useful both as an opportunity for training and to foster a spirit of cohesiveness. Some Institutes also re-invite CRs after three years or so to convene as a group, or for half-hour individual meetings. This seems like far less than would be needed for adequate monitoring of progress, identification of possible problems, and opportunities to offer positive advice and encouragement – especially for CRs from less privileged groups for whom the practices of a research laboratory may be less natural and familiar.

Institutes' deputy directors often closely monitor the progress of CRs and provide mentorship. They keep in close contact with UMRs and they are the first line of intervention when researchers encounter difficulties with the group they are working with.

However, based on what it heard, despite the professional development opportunities available to support staff, the committee considers that the CNRS mentoring program has not kept pace with the evolution of best practices in similar organizations elsewhere. An ambitious mentorship program should be developed, and every employee – from all categories: researchers, engineers, and administrative and technical staff – should have a formal mentor, with the perspective of establishing a long-term advisory relationship. The CNRS should develop training for mentors, and ensure that the advice that is dispensed conforms to modern policies and expectations; this can be a challenge for more senior employees who were hired decades ago when expectations of conduct were different from what they are today.

The committee also observed that there is no formal program designed to support the advancement of CRs to DR positions. This appears to be a missed opportunity, especially given the need to improve gender balance and the reported lower proportion of female applicants to DR positions, qualifications notwithstanding.

c/ Supervising students

While the primary "ownership" of graduate education resides in universities and *grandes écoles*, CNRS staff plays an important role in the education and training of graduate students. This is certainly a subject where continuous improvement is needed to develop and apply best practices, together with partner higher education institutions. In particular, best practices elsewhere include having a one-to-many formal advising relationship between graduate students and their advisors, and having annual committee meetings to keep track of appropriate progress toward degree completion.

Supervising PhD students is a contribution to education on which the future of research depends for the development of the talent pool of tomorrow. The participation of junior researchers (*chargés de recherche* and *maîtres de conférences*) in this supervision is certainly to be encouraged, and fully recognized as a substantial aspect of their contribution to research. When they are involved in the supervision of a thesis, it is important for young researchers to take part in the thesis defense committee, as is permitted by current administrative texts.

d/ Misconduct

The committee has heard several concerns about the management of misconduct and other difficulties in the daily life of the UMRs. This also seems to be an area where increased attention from the CNRS is needed. The committee makes the following comments and suggestions.

- It is unclear whether the CNRS procedures for dealing with workplace bullying and harassment are known to the entire CNRS community.
- One concrete example of mishandling of misconduct that has been reported to the committee was the suggestion that the victim could change laboratories, a process that is facilitated by the CNRS. The committee can only hope that this kind of attitude is not commonplace. It emphasizes that it is unacceptable to expect the victim to suffer the consequences of misconduct. In cases of abuse, it is not the victim who should suffer major career upheaval but the perpetrator. The committee – while being aware that the reported situation might be quite singular – was troubled by the suggestion that this is not always the case.
- A robust training program to create an inclusive environment and foster leadership skills would help further the growth of every member of the CNRS research units and prevent problems.

IV. Relations with universities

1 / Partnership with universities, co-management of the UMRs and contribution to education

Recommendation 6: Deepen the partnership with universities, strengthen the co-management of the UMRs and the involvement of CNRS researchers in education

Joint research units with universities have become the prevailing mode of operation of the CNRS. To make these partnerships and collaborations even more successful in serving the CNRS's and universities' missions, in a context where universities have increased their strategic autonomy and research strengths, there is a need to update and clarify roles, leadership and strategies, as well as to monitor their impact.

Sub-recommendations

- 6.1 Revisit the partnership with universities, including the co-management of the UMRs and the contribution of CNRS researchers to education.
- 6.2 Pursue efforts towards building broader – inter-Institute – long term partnerships with some of the large French research universities, including leaving leadership to them on specific topics.
- 6.3 Together with the universities and other home institutions of the UMRs, establish a clear shared governance system for the UMRs.
- 6.4 Decentralize as much as possible the CNRS operational processes and its decisions on allocating resources to the UMRs, so that these decisions can be made in concert with partner universities.
- 6.5 Together with the universities and other home institutions of the UMRs, empower the UMRs' directors and strengthen their ability to play a leadership role, including active participation in decisions, true influence over the evolution of the research done in the UMR, and leverage over the corresponding resources.
- 6.6 Partner with universities in sharing the teaching load at the level of the UMR as a collective place in which all members can be involved in educational tasks and duties. Encourage CNRS researchers to contribute to education and provide means for helping them to do so.
- 6.7 Define a common framework and interoperable platforms making the consolidation of management data and information possible and easy to handle at all levels.
- 6.8 Build shared objectives and consolidated indicators at the university site level.

a/ Governance and co-management of the UMRs

As stated in the introduction, almost all research units of the CNRS are joint research units (UMRs), mainly with universities. With no legal personality, a UMR is a sort of "joint venture" common to several "home institutions".²⁰ The committee noted several avenues for improving the governance of these UMRs and for their shared management by the CNRS and universities.

- Strengthen the role of the UMR directors
The committee observed in its meetings with UMR directors that their role seems essentially restricted to administrative management. UMR directors are bound by decisions taken elsewhere without their participation or advice. They consider that they are not in a position to influence the evolution of research in their UMR: directors have very little resources at their disposal and the funding for research

²⁰ There is a national framework for UMRs. The common features of UMRs are the following:

- The creation of a UMR relies on a five-year renewable contract between the home institutions. The director of the UMR is jointly appointed by the home institutions.
- The home institutions allocate financial resources and staff to the UMR.
- The UMR is organized around scientific teams.
- All scientific publications of the UMR are credited to each of the home institutions. These institutions are co-owners of the inventions developed in the UMR (e.g. patents).

projects is only obtained through calls for projects from the ANR (national research agency). Consequently, the position of UMR director seems to be very unattractive.

The committee considers that this topic is of major importance for the present and the future of the CNRS and French research. Resolute action should be taken to empower UMR directors and strengthen their ability to play a leadership role and have true influence on the evolution of research in UMRs.

This also means that the balance between ANR funding and operators' funding for performing research in laboratories is a key question that deserves enhanced attention from the ministry.

- Establish an effective governance system for the UMRs, shared among all home institutions
The assessment committee did not investigate if the DOR meetings (see Section II.1.e above) are the appropriate format for the governance of the UMRs, or if alternative formats should be envisaged. It insists that an effective governance should be installed for each UMR, allowing the UMR director and all home institutions of the UMR to regularly meet and discuss the UMR's strategy and main objectives as well as its needs for resources. Generalizing the installation of such a clear and shared governance for each UMR should be seen as a major task for each Institute.
Moreover, the CNRS should hold regular meetings with each main partner university to jointly examine the resource needs of their common UMRs, discuss priorities and elaborate concerted decisions for the allocation of resources to these UMRs.
- Decentralize the CNRS operational processes as much as possible
The CNRS allocation of resources to UMRs is highly centralized: the 10 Institutes "own" the budget allocated to the units, researcher positions and the support staff positions for engineers and technical and administrative staff. The committee also observed that technology transfer and relations with private companies are also managed centrally. However, the basic principles of management state that responsibility and decision making should be delegated to the lowest possible level (principle of subsidiarity), which is clearly not the case in the current system. The committee recommends a real push towards decentralization to the "sites" or to the regional level on several aspects:
 - the management and allocation of administrative staff positions;
 - the management and allocation of engineer and technical staff positions, except for some "national platforms" and big "national projects" such as those managed by some Institutes;
 - the management and decision-making responsibility concerning technology transfer and relations with private companies, except for large national and international companies.

Decentralization would permit a better understanding of the needs of the UMRs and pooling of resources at the local or regional level. In addition, it would facilitate concerted allocation decisions with partner universities. It would also enable greater proximity to the regional economy, and facilitate the partnership with universities for innovation and technology transfer activities.

- Define a common framework for consolidating and sharing UMRs' management data
The strength of the UMR "system" is at the core of the CNRS model. However, it comes with very high transaction costs, and research capacity is suffering from too many interfaces. A major illustration of this observation relates to the fact that the home institutions of a UMR operate with heterogeneous administrative information systems.
Rather than the utopian goal of harmonizing these information systems, the objective should be to build a common framework for consolidating and sharing management data. This would allow the UMRs and each of the home institutions (CNRS, universities) to have an integrated and coherent view of the unit's resources (ex ante) and of their use (ex post), in a common interoperable format. This will increase the transparency of the "UMR system" and enhance trust among the institutions. This improved transparency will make it possible for the administrative management of a UMR to be performed by only one of the home institutions, so that the UMR uses only one administrative information system²¹.

b/ Contribution to education

CNRS researchers contribute on a voluntary basis to education: they advise students within the UMRs and they take on teaching responsibilities within the universities and *grandes écoles*. Involvement of CNRS researchers in teaching is entirely left to individual preferences. According to the SAR, more than 180,000 hours of teaching are provided each year by approximately 6,000 CNRS researchers, which corresponds to an average of 30 hours per person; the CNRS asks for the teaching load to be limited to one third of the statutory service of a professor, 64 hours of tutorial equivalent.²²

²¹ Today, according to the CNRS, more than half of the UMRs are in a situation where, on the basis of an agreement between the unit's home institutions, the administrative management of all the unit's research contracts (with a few exceptions) is entrusted to one of the home institutions. But these UMRs use several administrative information systems, since the unit's expenses made on the basis of the funding received from each home institution is managed within the information system of this institution.

²² Source: SAR.

The committee notes that the division of teaching loads is very heterogeneous within UMRs, and it recommends revisiting this by encouraging CNRS researchers and engineers to contribute to education. In the proposed vision, the allocation of teaching loads would benefit from being managed in close relation with the UMRs. Within the framework of a partnership agreement with the CNRS, the university would allocate to each UMR the responsibility to contribute a certain number of teaching hours, to be covered by the members of the UMR (university *maîtres de conférences* and *professeurs*, CNRS researchers, others). This would allow university academics to be relieved of a certain number of teaching hours, thus having more time to invest in research projects; at the same time, CNRS staff in these units would be assigned of a certain number of teaching hours on a voluntary basis.

In this vision, it is likely that few CNRS researchers would teach more than 64 hours. However, 64 hours should not be a uniform limit imposed by the CNRS: it could be of interest to allow greater involvement in teaching activities by some willing researchers at some periods in their careers. The idea would be to favor flexibility in teaching contributions, and in particular to make it possible for the universities to grant more “course releases” to young *maîtres de conférences*. In the new model proposed here, it would be necessary to create appropriate incentives, both for individuals and for UMRs, which will become collective places with members involved in education and research tasks in a more balanced way. The committee suggests that the ministry could find ways to encourage this evolution, starting experimentally on sites where actors are willing to embark on this perspective.

The committee firmly believes that the proposed transition towards a substantially increased contribution from the CNRS to education – without changing the “*statut du chercheur*” – would be highly beneficial for the higher education ecosystem in France, and for French society as a whole. It also believes that it will be beneficial for CNRS research.

c/ A deepened partnership with universities

Increasing the contribution of the CNRS to the emergence of large French research universities at the international level is a key topic of the COP for the 2019-2023 period. This was expected to take place – at least with some of the large French universities – through a strengthened partnership based on “site policies” shared between the university and the CNRS, with explicit common objectives and with an enhanced capacity to lead joint initiatives.

The SAR gives little information on the actual progress made in this perspective in recent years, and it emphasizes the fact that the quality of the CNRS relationship with Idex and I-Site universities is uneven.²³ However, the committee was pleased to note that some substantial progress has been made. With some Idex universities, the CNRS, which was a partner of the Idex project from the beginning, actively participates in the “Idex steering committee” chaired by the university; the CNRS representative is the “site referent director” (SRD). The Idex steering committee decides on how to use the Idex funding, for instance, for internal calls for projects in support of new research and teaching initiatives, for scientific equipment, for allocating “packages” to some new recruits in the UMRs, etc. Both the CNRS and the university are very positive on these joint initiatives, and on their joint work in the Idex steering committee. Within this steering committee, they also work together to prepare joint answers to some national calls for projects aimed at supporting the main university sites. The committee also noted other interesting initiatives: here or there, for instance, the university and the CNRS have put in place a joint team to support innovation projects and relations between the UMRs and local companies, or a joint team to provide support for European projects.

However, the committee observed several limitations of the present CNRS partnership with universities. Some key topics like international relations or the contribution of CNRS researchers to education do not seem to be discussed with most partner universities. Also, the improved dialogue between SRDs and partner universities does not include issues related to the co-management of the UMRs. The point of contact for a UMR director within the CNRS is a deputy director of the Institute to which the UMR is attached, in Paris, and most UMR directors do not have any regular contact with – or do not even know – the SRD.

The committee insists that it is of primary importance for the CNRS to build a deeper, broader inter-Institute partnership with universities, based on regular dialogue covering all strategic topics.

The committee also endorses a proposition given in the SAR that the ministry should use genuine “site” indicators in relation with common objectives of, say, the CNRS and a university. For instance, using the amount of funding obtained from EU – or from private companies – for all UMRs of a given site as a key performance indicator (KPI) for this site, and giving the CNRS and the university joint responsibility over the evolution of this KPI, will help them to strengthen the partnership. On the opposite, choosing separate KPIs that push each of the two institutions to grow its own contractual funding only encourages sterile competition.

²³ Source: SAR. “Idex” and “I-Site” are labels of excellence given to some of the French universities by the *Secrétariat général pour l’investissement* (SGPI).

2 / Administrative procedures and bureaucratic burden

Recommendation 7: Launch a “commando operation” to respond urgently and decisively to the need to simplify administrative processes and reduce the bureaucratic burden on the CNRS community

Agility, flexibility and efficiency are essential to all world-class scientific research organizations. Based on the discussions with CNRS scientists and administrators, the committee judges that there is an urgent need to simplify administrative procedures at all levels. Decisions should be made rapidly, some of them being in the sole hands of the CNRS while others concern subjects shared with universities and other home institutions of UMRs.

Sub-recommendations

- 7.1 Empower a task force in charge of rapidly identifying, from the perspective of the teams in UMRs, ways to simplify, unify, and streamline all aspects of daily practice, including the functions of procurement, hiring, human resources, contracts, partnerships, and financial management. This should also include policy recommendations to increase operational efficiency.
- 7.2 Rapidly take decisions and implement concrete measures. Provide the necessary budget and resources to respond urgently to the needs.
- 7.3 Reconcile academic and administrative activities, notably by reinforcing the notion of “service” and mutual trust, with the aim of supporting the scientific community and facilitating rather than controlling research activities.
- 7.4 Define a plan for recruiting and retaining permanent engineers and technical and administrative staff, particularly in contexts where this category of staff is highly sought after by other institutions and industry.
- 7.5 Build appropriate indicators to regularly measure the evolution of the administrative burden on researchers.

Significant concerns about administrative processes were reported to the assessment committee. Research staff expressed their frustration and exasperation about the increasing and sometimes even absurd complexity of administrative procedures, which create more and more obstacles to their core research activities. The wide latitude given to scientific staff in how they spend their time, with accountability on long timescales, stands in great contrast to the apparent micromanagement of even minor procurements; this strikes the committee as a sub-optimal level of scrutiny. The staff time spent assembling, reviewing, and reimbursing minor expenses far exceeds the monetary value of those expenditures, for example. Slow administrative procedures can lead to terrible situations such as long delays in obtaining funding or even the loss of a grant.

The increasingly heavy administrative burden is felt by scientists at all levels within UMRs. As administrative challenges increase, fewer scientists (particularly women) are interested in the responsibility of UMR director; some young researchers mentioned spending up to 50% of their time on administrative tasks.

CNRS administrative staff are the primary victims of an overall global system that is deviating from its mission of supporting research through efficient administration. Administrative staff is under growing pressure due to lack of resources, complexity of procedures, and high turnover, which might put the CNRS at risk in terms of efficient support to its scientific mission. More and more work is carried out by fewer and fewer properly trained permanent support staff, which results in the burden of constantly having to train temporary staff, so that stores of institutional knowledge cannot be built up. Engineers and technical and administrative staff also showed dissatisfaction with the way their work is credited and perceived by CNRS management; globally, there is a lack of recognition for support staff despite their critical function.

The committee considers the overall operation of CNRS to be significantly hampered by the complexity and length of administrative processes that entail very large direct and indirect costs. The administrative burden is too heavy at all levels, and CNRS senior management seems to not fully appreciate the deep level of frustration across the system. There is a stark contrast between the efforts made to make technology transfer more agile and the apparent lack of urgency in addressing administrative inefficiency and frustration.

Disparities among UMRs in terms of the quality of administrative support were also reported to the committee. The size of a UMR matters in its administrative capacity to build a more stable and service-oriented environment. Significant variations in the size and scope of UMRs make it more difficult to identify a solution that fits all.

While being aware that the CNRS is subject to external constraints (the common rules of the French public administrations, the rules set by the research funding organizations, etc.), the committee insists that there is an urgent and genuine need to redesign CNRS administrative processes by systematically complying with the law in the least restrictive interpretation possible. A “commando operation” must be launched, with strong commitment and close scrutiny from senior management. A dedicated task force should be empowered, and it should include scientists and administrators from the CNRS – from UMRs and from regional offices – and from partner universities. Precise observations and recommendations for simplification and efficiency of administrative procedures have to be made as soon as possible, followed by rapid decisions on the subjects that are solely in the hands of the CNRS, and by determined joint actions conducted with the partners on topics that are shared with other institutions.²⁴

Issues concerning the recruitment, careers, and training opportunities of the CNRS support staff also deserve a determined action plan. Several persons interviewed by the committee have underscored the lack of attractiveness of some CNRS positions for administrative and technical or engineer profiles.

Concerning the support staff within the UMRs, it is worth emphasizing that the CNRS currently provides, in proportion, a much larger share of UMR support staff than the universities, as the figures given in the introduction show. This imbalance is a source of difficulties. In the committee's understanding, strengthening the universities' ability to increase their contribution of support staff to UMRs is certainly a key element in consolidating the UMR model.

²⁴ While noting that work on CNRS internal rules and procedures is definitely and urgently needed, the committee understands that a joint work with partner universities and other home institutions of UMRs is also necessary to reach the best level of simplification for the administrative management of the UMRs. This is why this topic is included in this chapter.

V. Research, scientific policy and partnerships

Recommendation 8: Strengthen the scientific policy and the partnership strategy, as well as risk taking, and implement regular international expert reviews and benchmarking

Excellence is a dynamic objective that needs to be relentlessly pursued through a scientific strategy that responds quickly to changing circumstances, and a culture of benchmarking, feedback, periodic assessments and monitoring of the excellence and impact of research.

Sub-recommendations

- 8.1 Develop a better defined scientific policy.
- 8.2 To monitor research excellence and impact, develop tools including quantitative metrics that support qualitative research assessment and are both accurate and interpretable to the international scientific community.
- 8.3 Create a general framework to assess the overall impact of the CNRS in all aspects of its contributions to society.
- 8.4 Facilitate the emergence of new research themes, particularly those that promote inter- and transdisciplinarity.
- 8.5 Clearly define guiding principles, establish success criteria and offer incentives to further develop interdisciplinarity while preserving international excellence in the underlying disciplines.
- 8.6 Clarify the partnership strategy, with the objective that each scientific partnership targets an identified expected contribution to the implementation of the CNRS scientific policy.
- 8.7 Have all Institutes undergo regular international review.

1 / Scientific policy and partnerships

The scientific policy of the CNRS covers several aspects, from the choice and implementation of research priorities to measures aimed at promoting and facilitating interdisciplinarity, the emergence of new research themes, and risk taking. The CNRS strategy for scientific partnerships is also discussed in this section, since it should bring a major contribution to the implementation of the CNRS scientific policy.

a/ Research priorities

The research priorities of the CNRS have been defined in the COP for the 2019-2023 period.

- They consist of six “major societal challenges”, namely climate change, educational inequality, artificial intelligence (AI), health and the Environment, territories of the future, and the energy transition. The objective set in the COP is to increase the percentage of the newly-hired researchers that work on themes directly related to one of these societal challenges from 35% to more than 50% between 2019 and 2023.
- The COP also lists 39 more focused thematic priorities, such as “multi-scale characterization of matter”, “the matter-antimatter asymmetry problem”, “a safe digital world”, “formation of planets and appearance of life”, “digital humanities”, and “the human brain and cognitive functions”.

In addition to these priorities of the COP, the SAR included a presentation of the main strategic directions for each of the 10 Institutes.

Choosing priorities is not easy for the CNRS. For instance, the committee noted that the Institutes' specific strategies are sometimes very broad and vague, or somehow include all possible topics. The CNRS itself recognizes that it is “a heavy ocean liner”;²⁵ it is difficult to choose priorities and to keep the diverse activities efficient, agile, and effective. The committee notes, however, that several Institutes have set up mechanisms to regularly identify research priorities for the middle-term (5-10 years). It also considers that the choice made in the COP to put a strong emphasis on “societal challenges” is to be welcomed. Since it is too early to assess the impact of these choices, the committee considers that it would make sense to keep most of these “societal challenges” as priorities for the next COP for the 2024-2028 period, and it recommends carefully preparing the specific assessment which is to be done during the next COP to evaluate the outcome of the efforts made on these priority topics (growth of the resources and of the scientific production, major results and impact, etc.).

²⁵ Source: interviews held during the assessment visit.

The committee did not understand the process put in place in 2018-2019 to elaborate the COP scientific priorities. It suggests setting up a participative process to work on the priorities for the next COP. The CNRS should develop collective, bottom-up procedures to identify research priorities in the medium and long term, in coordination with its partners (universities, other national research organizations, etc.).

b/ Interdisciplinarity

The committee observed that interdisciplinarity is now widely encouraged within UMRs, within Institutes and across Institutes in the CNRS, through various mechanisms. There is seed money for researchers with promising ideas to meet and co-construct interdisciplinary projects, and for researchers to change labs to further develop their interdisciplinary perspective. The fact that the main research priorities defined in the COP are societal challenges, which are interdisciplinary by nature, is an additional proof of the CNRS's efforts to build on its strengths in scientific disciplines as a foundation for high-quality interdisciplinary research.

In the meantime, the committee observes that it is difficult to assess the impact of these efforts. Concerning interdisciplinarity, the SAR describes the measures and mechanisms that are in place, and gives information on the number of interdisciplinary projects that have been launched and funded, but it is silent on their results and impact. Moreover, it is not clear how the interdisciplinary nature of publications is evaluated. The committee has also understood that some UMRs that are "highly interdisciplinary and inter-Institute" have difficulties securing resources and hiring young researchers, because the CNRS is mainly structured around scientific disciplines, with the Institutes and the sections of the National committee for scientific research.

The committee recommends that the CNRS pursue its efforts to seize the opportunities of inter-disciplinary or trans-disciplinary research, while increasing its attention to the related difficulties in terms of recruitment and assessment. It also suggests that the CNRS better identify its most successful interdisciplinary projects and widely communicate about them.

c/ Emergence of new research themes

The committee has a positive impression about the numerous mechanisms set up to sustain the emergence of new research themes. The strong commitment of the research teams met by the committee also increased its confidence that the teams do their best, at their level, to seize the opportunities of new emerging topics. The committee noted that there is a widespread feeling among directors of Institutes that some additional efforts would be welcomed: they support the idea of a small fund guaranteed on a long-term (10-year) basis to allow more nimbleness in responding to emerging research priorities.

Again, the committee recommends the CNRS to better identify the main successes in terms of emergence of new research themes and to communicate on them.

d/ Risk taking

Because high risk/high reward initiatives can have difficulty attracting conventional grant funding in their initial stages, they deserve particular attention and support. This subject is present in the SAR, but only to a limited extent. Since they have job security, CNRS researchers can afford to explore new, risky, highly interdisciplinary areas of research. The committee noted that there is a lack of risk taking in applying for competitive funding like senior ERC grants, which requires a cultural change, especially at the level of senior researchers. The CNRS should strongly encourage researchers to exploit their secure positions to take more risks, for instance by applying for ERC Advanced grants and persevering in the face of initial failure (see Chapter VII).

e/ Strengthen the scientific policy

The assessment committee considers that the CNRS should clarify and strengthen its scientific policy. This reinforced and ambitious scientific policy should include the CNRS vision of the evolution of science and the role and impact of scientific research in today's and tomorrow's society – in all dimensions: contribution to new knowledge, contribution to education, to innovation, to public policy and to society as a whole. This scientific policy should identify key scientific questions and major "societal objectives" for which the CNRS aspires to bring major contributions and solutions, based on its vision of its main scientific strengths. And it should also include the CNRS vision on how it intends to implement this policy, highlighting the prominent role of its partnerships with universities, developing its strategy for mobilizing and allocating resources, leveraging a reinforced partnership strategy (see below), and relying on its basic "values", such as the crucial attention paid to giving researchers freedom and time to develop excellent fundamental research.

Without insisting on the fact that this is closely related to what was written in Section II.1.a above concerning the strategic role of the Board of Directors, the committee urges the CNRS to define this vision and this policy and widely communicate on them. It stresses the necessity for this definition to take place within the framework of a clear, open and participative process, facilitating the involvement of UMR employees and associating partners (universities, other national research organizations, etc.).

f/ Strengthen the partnership strategy

Collaborative research and partnerships with a diverse range of public and private actors is a prevailing feature of the CNRS. Considering the importance of this mode of operation, the assessment committee recommends that the CNRS develop a stronger and clearer partnership strategy, with corresponding action plans, and with the mid-term goal that each scientific institutional partnership – whether with public or with private partners, whether within or outside of France – brings a well-identified contribution to the implementation of the CNRS scientific policy.

This may include several aspects that should be clarified and strengthened.

- First, it would be worthwhile for the CNRS to be more explicit on the scientific topics that it considers to be strategic in its partnership with each French university.
In the same spirit, the committee also encourages the CNRS to work – together with partner universities – on how to assess its involvement on a university site. In the medium-term, the CNRS should be able to decide to end partnerships with some sites and create new partnerships with others.
- Second, clarifying the partnership strategy at the Institutes level can help to develop interdisciplinarity, in a vision where each Institute should cultivate ties with leading teams in other disciplines, both within France and internationally.

2 / Scientific production

a/ Worldwide recognition but a need to strengthen international evaluation

The assessment committee is pleased to acknowledge the worldwide first-class recognition of the scientific production of the CNRS.²⁶ In each field of science, there are teams in CNRS UMRs that are among the very best research teams acting as leaders at the world scale. The committee is also glad to underline that the researchers it met with during the assessment visit were uniformly enthusiastic about their work and the freedom they enjoy to conduct long-term – mostly fundamental – research.

With regard to the overall view of the CNRS research activities and results, it is worth remembering that the committee was not asked to assess the scientific quality of the CNRS in detail. Instead, the committee focused its attention on the question of how the CNRS is able to assess the quality of its scientific production in the international context²⁷. This is certainly an area where the CNRS needs to improve. Indeed, reading the SAR gives the impression that the CNRS considers that excellence is everywhere in its research activities. The CNRS does not have a strong tradition of independent external reviews, and the committee thinks the entire organization would benefit from implementing this, both at the Institute level and for cross-cutting initiatives. The CNRS should strengthen its ambition for scientific excellence by developing a stronger culture of international assessment and benchmarking, and of regular feedback and monitoring.

The committee makes the following comments, suggestions, and recommendations:

- The CNRS is a signatory of the DORA agreement to improve the assessment of research quality, but the development of alternative methods of evaluation of excellence is still very much a work in progress, with little coordination within the CNRS and with international peers.
- The CNRS should involve more external, especially international, experts in the evaluation of individual researchers on a regular basis, and it should ask Hcéres to involve more international experts in the assessment of the UMRs, to ensure not only that the CNRS considers that it meets the highest standards, but also that it is seen to do so by peer institutions.
- The CNRS should also ask Hcéres to pursue its efforts to distinguish, through the assessment of UMRs, between research units or teams whose results are “world-class”, those whose results “have international recognition”, and those that have a “national reputation” or a “local reputation”.²⁸
- Periodic international reviews should also be done at the Institute level.

²⁶ The expression “scientific production of the CNRS” stands for the scientific production of all CNRS UMRs. It is indeed one of the very principles of the “UMR model”: the publications of a given UMR are attributed to each of the home institutions of the UMR. Among the home institutions of a UMR, no attention is given to which institution is the employer of which author of a publication.

²⁷ This question was raised in the *Terms of reference*, for the CNRS as a whole and in the field of each Institute.

²⁸ In the course of the present assessment of the CNRS, Hcéres has produced a document presenting a synthesis of the evaluations of all UMRs attached to a given Institute of the CNRS, as a first attempt to try to give a synthetic overview of the research done at the scale of one Institute. This synthesis included identification of excellence as it is assessed in UMRs' evaluation reports (using the “categorization” with “world-class” or “international recognition” or “national reputation” or “local reputation”). Such a document was made for INEE (Institute of ecology and Environment) and for INSU (National Institute for Earth and space sciences).

b/ Assess research performance and impact

The CNRS seems to make very little use of tools to assess and measure its research performance and impact, and to carry out benchmark analyses with world-class research institutions. It should develop such tools, and make them as legible as possible to the international scientific community.

Bibliometric analyses are part of these tools, and the assessment committee received bibliometric information from three different sources.²⁹ The committee analyzed the relevance of this information, and observed the heterogeneity and lack of comparability of the methods and approaches used. In particular, this analysis made it possible to shed light on the margins of uncertainty in the measurement of citation scores; these margins of error have to be considered when presenting results, to account for the uncertainty and biases inherent in one or the other approach. However, the committee noted that the observation of a substantial gap between the citation scores of the CNRS and of the *Max Planck Gesellschaft* (MPG) appears to be a robust result.

Despite these biases and inaccuracies, and taking all the usual precautions, bibliometrics remains an internationally recognized approach to the evaluation of scientific research. In addition, bibliometrics is a way of making visible the quality and excellence of an institution's scientific output. The assessment committee recommends that the CNRS develop a clear and strong methodology on the subject of bibliometrics, with the aim of being able to present a solid and detailed analysis at the next international assessment to be carried out. In this context, the CNRS should analyze the possibility of establishing benchmarks with similar institutions worldwide. The committee also suggests that the CNRS carry out a study to understand why its citation scores lag behind those of several major foreign institutions.³⁰

3 / Open science

The development of open science has been a priority for the CNRS in the last five years, with a broad vision including not only open access publications, but also sharing of research data and open-source software. The CNRS drafted an Open science roadmap in 2019 and a Research data plan in 2020.

The CNRS has set a target of 100% open access publications for 2023. The rate of open access among the publications of CNRS UMRs has grown from 48% in 2018 to 77% in 2021³¹. There is a national publication repository, HAL, where manuscripts and publications can be deposited and become openly available. HAL is linked to the form that CNRS researchers need to fill in for their annual activity report: in order to report a scientific production, they have to go through HAL; this ensures that manuscripts and publications are deposited regularly into HAL. The CNRS has played an instrumental role in recent years for the consolidation of HAL as a national open archive,

²⁹ Hcéres has produced a document entitled "Analysis of the scientific and technological profile of the CNRS". This document (<https://bit.ly/2023-analysis-scientific-technological-profile-CNRS>) provides indicators on three types of CNRS scientific and technological productions: participation in the European framework programs for research and innovation, scientific publications, and patents. For European projects and for publications, the analyses systematically include comparisons with foreign institutions.

The bibliometric analyses presented in this document use the publication database of OST (*Observatoire des sciences et techniques*, a department of Hcéres), which is an enriched version of the Web of science (WoS). Very briefly, the main takeaways from these analyses are as follows:

- The publications of CNRS UMRs represent 43% of French publications (this percentage is close to the percentage given in the Introduction above: CNRS UMRs represent over 40% of the total workforce of the French public research ecosystem). This highlights the unique national position of the CNRS; as a comparison, the share of CAS (Chinese Academy of sciences) and MPG (*Max Planck Gesellschaft*) publications in their own countries is much lower, respectively 6% and 4%.
This CNRS share of French publications is not even across disciplines, ranging from 70% in mathematics, physics, and chemistry to less than 30% in social sciences, and around 10% in medical research.
- The scientific profile of the CNRS is analyzed on the basis of two different nomenclatures, and compared with the profiles of foreign institutions.
- Measures of the citation scores of the publications are also given. The normalized citation scores of the CNRS appear to be lower than those of the CAS and MPG in most disciplines.
- Last, the document reports benchmark analyses of CNRS publications in the scientific field of each Institute, except in the field of humanities and social sciences.

In addition to this document, the assessment committee examined the bibliometric analysis provided by the CNRS in the SAR – which essentially focuses on measuring (in the WoS database) the access of CNRS publications to scientific journals with the top 10% highest journal impact factors – as well as a separate analysis of citation scores of the CNRS and MPG, carried out by a member of the committee using another publication database (Dimensions).

³⁰ On a different but related topic, the committee notes that the SAR recognizes that the CNRS performance in the HCR (Highly cited researchers) ranking is "mediocre" (see SAR, page 21). It would also be interesting to understand the reasons for this. One reason is probably that the organization of CNRS research aims at building teams, with close interactions between scientists of various generations, which is different from other types of institutions which privilege the prominence of brilliant individuals.

³¹ Source: SAR (Appendix C6). A different measure of the open access rate is given in the Hcéres bibliometric analyses (<https://bit.ly/2023-analysis-scientific-technological-profile-CNRS>): it also shows a substantial increase, from 58% in 2017 to 74% in 2020.

under the supervision of the ministry in charge of research. It also works to support bibliodiversity, notably through publishing platforms that offer the guarantees of peer review but are not-for-profit.

Sharing research data, i.e. making it "openly accessible as much as possible but closed as much as necessary" is the second major objective. Action is taken to disseminate a culture of FAIR (findable, accessible, interoperable and reusable) data, to publicize existing data services and tools, and to support the creation of new practices, services and tools. Concrete efforts are underway to facilitate the sharing of data. The CNRS is taking part in the *Recherche Data Gouv* project for a national research data platform led by the ministry.

Open science is clearly a subject where the CNRS has a strong commitment and momentum, and plays a leading role in France. The on-going transformation should continue to be pursued. The assessment committee is pleased to observe that several Institutes have mechanisms in place to promote Open science. It recommends reinforcing measures to further research data openness at the Institute level, to account for the specificities of the scientific communities, especially in fields where data sharing is less advanced. Progress in sharing research data should be monitored on a field-by-field basis.

VI. Innovation and relations with companies

Recommendation 9: Accelerate the development of innovation and transfer to society

Remarkable efforts have been deployed to enable the transfer from research to innovation. The committee recommends identifying and widely communicating on where such initiatives can be accelerated, including in social innovation, what their success criteria are, and what the next level of achievements will look like. To achieve this acceleration, partnerships should be developed with international leaders and with regional actors in close interaction with universities, and incentives should be created.

Sub-recommendations

- 9.1 Further develop an innovation culture within the CNRS to complement its "raison d'être", which should include innovation in parallel to performing first-class fundamental research.
- 9.2 Further strengthen the role of the CNRS in social innovation processes such as nature-based solutions, community-based adaptation and resilience, communities of learning and other non-industrial paths to innovation.
- 9.3 Further develop partnerships with regional actors in close interaction with universities, to reach the next level of sharing of technological and social innovation with society in all fields of science and technology. Better share with universities the responsibility of managing technology transfer and relations with regional stakeholders and industrial partners.
- 9.4 Build a challenge-driven program to stimulate disruptive innovation. Define with stakeholders big challenges calling for innovative solutions. Support the development as long as possible. Manage at the national level large collaborative innovation projects with industry that require aligned activities from many UMRs.
- 9.5 Take responsibility to maximize the access to risk capital and seed funding for startups, including the organization of nationwide awareness initiatives, accelerator activities and exchange of best practices; create focused and effective partnerships to achieve these objectives.
- 9.6 Develop a central strategy for collaboration with companies leading to a set of new strategic joint laboratories in France and abroad.
- 9.7 Reinforce partnerships supporting European and international development of industry.
- 9.8 Evaluate the socio-economic impact of CNRS activities.

1 / Dynamic innovation activities

In the last five years, the CNRS has demonstrated a strong willingness to increase its innovation, knowledge and technology transfer activities. It has implemented a functioning framework aimed at identifying, evaluating, incubating, and seed funding the translation of research with commercial potential. Its achievements are highly valued by some of its industrial partners, and some UMRs have a stellar reputation in terms of transfer to industry. Its potential impact on innovation for the French economy and society is very high.

Boosting the creation of startups, strengthening relations with private companies, and developing intellectual property (IP) management were the three priorities of the 2019-2023 COP in terms of innovation.

- Concerning the creation of startup companies from the CNRS UMRs, a new funding scheme was created for "pre-maturation projects", i.e. for supporting the early stages of development of emerging technologies. Between 2017 and 2021, an annual average of about 100 startups have emerged from CNRS UMRs; this number has doubled in comparison with the first half of the 2000s. The CNRS has strengthened its coordination with SATTs (*sociétés d'accélération du transfert de technologie*), which it considers to have played an instrumental role in helping to secure the transition from research to the creation of economic value,³² while noting that their quality of service varies.

The committee is pleased to note that the CNRS has implemented a follow-up of the startups that grow out of the UMRs. Observing that most of the startup founders met during the interviews stated that they had to use their own contacts and abilities to negotiate investment rounds with venture capital (VC) funds, the committee encourages the CNRS to take initiatives to maximize access to risk capital and

³² Source: written answer of the CNRS to a written question of the assessment committee.

seed funding for startups. The committee also notes that there is still a significant gap in taking early-stage companies through the “valley of death” to more substantial VC funding.

- The CNRS has taken several new initiatives to strengthen its relationship with industry: targeted communication events, clubs, increased participation in national “industry strategic committees” with a focus on nine priority sectors, etc. Specific efforts are devoted to developing bilateral relationships with strategic partners, in particular through joint research laboratories, the goal being to reach 400 joint laboratories with industry by the end of 2026, up from 200 in December 2021. These joint labs are created for a 4- or 5-year renewable period; on average, 38 joint labs have been created and 21 have been shut down every year over the 2017-2021 period.
- Action was also taken to improve the management of the patent portfolio. The annual number of patent filings between 2017 and 2021 is close to 700; it has doubled since the early 2000s. The CNRS has a territorial protection policy, aiming at balancing potential market opportunity and patent costs: 70% of the portfolio of patented inventions are protected in Europe, more than half in North America and one fourth in Asia. Revenue from the patent portfolio has substantially grown between 2017 and 2021, while costs are constantly decreasing and are lower than revenue.

However, the situation regarding the practical aspects of IP transfer is unclear. The transfer must be operated quickly and efficiently; this question deserves close attention and monitoring.

2 / Strengthen the innovation culture and policy

While welcoming the momentum in the areas of innovation and relations with private companies, the committee notes that it is still difficult to assess the results of the action taken in the last five years. The CNRS itself recognizes that the annual number of startup creations, as well as the annual number of patent filings, has reached a plateau since 2016 or 2017.³³ The efforts have to be pursued and strengthened to allow the CNRS to achieve its full potential for innovation.

The committee considers that the CNRS innovation policy should be clarified and reinforced in several areas:

- There is a lack of clarity regarding the strategic drivers for technology transfer and how projects are selected, assessed, terminated or expanded. For instance, the CNRS should not only consider novel technologies born of curiosity and then look for applications; it should also identify big challenges of economic, societal, and environmental importance and invite researchers to contribute to find solutions.
- The strategy on how the decision to protect an invention is made, and how the best path towards optimizing the impact is chosen, should be clarified. The main criteria for these choices and the main KPIs for the overall innovation policy should also be made clear, with a proper balance between KPIs focusing on short-term impact (e.g., number of companies created) and on long-term impact (e.g. jobs created in the long term).
- The COP for the 2019-2023 period included ambitious objectives concerning relations with small and medium enterprises (SMEs) and the construction of collective action with willing partner universities and *grandes écoles* to make local innovation systems more agile and efficient. From the reading of the SAR and the assessment interviews, it is not clear what progress has been made on these topics. Increased efforts are needed to develop innovation activities at the regional level, in close partnership with the universities, and with the appropriate decentralization of the CNRS support and decision processes.
- Innovation at CNRS mainly focuses on technology while the social innovation angle is underdeveloped.
- Also, the CNRS ambition to contribute to innovation at the European and international scale should certainly be strengthened.

More broadly, the committee considers that the CNRS strategic commitment to innovation should be more clearly asserted, and that the innovation culture within the CNRS should be developed. While continuing to pay close attention to researchers' freedom to conduct world-class scientific research, the CNRS should add “innovation for society” to its “raison d’être”. The committee recommends implementing specific measures to develop a culture of “innovation for society” in CNRS teams, including social innovation.

The committee observes that, according to the CNRS management,³⁴ there is a lack of recognition of the innovation activities in the individual assessment of researchers, and thus in their career development. This is obviously a major obstacle for the development of innovation culture and for the successful deployment of the CNRS innovation policy. While being aware that the assessment of success in innovation is a delicate issue, the committee emphasizes that it is of utmost importance to overcome this difficulty.

³³ Source: written answer of the CNRS to a written question of the committee.

³⁴ Sources: SAR and written answer of the CNRS to a written question of the committee.

VII. CNRS European commitment

Recommendation 10: Act as a driving force and source of proposals at the European level

Thanks to its size and the breadth of its expertise in all scientific fields, the CNRS is in a unique position to propose ambitious and visionary programs that contribute to the success and influence of European science and innovation.

Sub-recommendations

- 10.1 Bring together European scientific expertise to define ambitious and disruptive initiatives in original and innovative fields, in all areas and at their interface, in partnership with the best European institutions.
- 10.2 Build a strong European strategy, with universities and partners, and share it to facilitate the recognition of ambitions, orientations, and focus.
- 10.3 Set clear and ambitious objectives for increased participation in EU research and innovation programs.

The CNRS sees the participation of its researchers in projects funded by the European research council (ERC) as a major indicator of the quality of its research. This participation is indeed a remarkable success: the CNRS is the top recipient of ERC grants and has a larger number of grants than other large national research institutions (e.g. *Max Planck Gesellschaft* (MPG) in Germany), even when an estimate of their size is taken into account³⁵. However, a refined analysis reveals several areas where improvements should be strongly encouraged.

- The CNRS recognizes that it obtains very contrasting results at ERC depending on the Institutes,³⁶ and that its number of ERC submissions and ERC grants decreased over the 2017-2021 period.³⁷
- In the fields of life sciences and of social sciences and humanities, the CNRS success rate at ERC is far below the success rate of MPG.
- While acknowledging the CNRS success in obtaining junior ERC grants, the assessment committee observed that applications for senior grants fall steeply³⁸. In relation to its size and potential, CNRS should perform much better in terms of Consolidator and Advanced ERC grants.

Participation in the EU research and innovation programs beyond ERC also deserves several comments:

- The CNRS seems to put little effort into trying to act as coordinator of EU-funded collaborative R&D projects. Among the 813 European projects coordinated by the CNRS in the H2020 EU program (for the 2014-2020 period), no more than 60 projects are collaborative R&D projects.³⁹
- The committee considers that much work remains to exploit openings of the third pillar – called “Innovative Europe” – of the new EU program for the 2021-2027 Horizon Europe program. The CNRS should seize the chance offered by the fresh start of the European innovation Council (EIC). Within the third pillar, it should also aim at establishing new Knowledge and innovation communities (KICs).
- The SAR is silent on how the CNRS assesses the impact of the action taken – in the framework of the commitments of the COP for 2019-2023 – to increase its participation in EU R&D programs. A careful assessment of this impact should be performed before the next COP.
- The strategic directions given in the SAR for the participation of the CNRS in EU programs are limited to the Horizon Europe R&D program. Other EU-funded programs also deserve the attention of the CNRS.

More broadly, the committee believes that the CNRS, as the biggest research operator in Europe, should strive to play a leading role on the European research and innovation scene. On the one hand, it could enhance its influence at the level of the European Commission, drawing on its Liaison office in Brussels and the G6 network that allows it to adopt joint strategic positions with other national research institutions⁴⁰. On the other hand, the CNRS should build a strong and visible European strategy in relation with partner universities and research organizations, and boost its capacity to define and run ambitious initiatives with the best European public and private players in research and innovation.

³⁵ See <https://bit.ly/2023-analysis-scientific-technological-profile-CNRS>.

³⁶ Source: SAR. See also Appendix.

³⁷ Source: written answer of the CNRS to the Hcéres document “Analysis of the scientific and technological profile of the CNRS” (<https://bit.ly/2023-analysis-scientific-technological-profile-CNRS>).

³⁸ Source: interviews held during the assessment visit.

³⁹ Source: SAR. The CNRS has coordinated 418 ERC projects and 335 Marie Skłodowska-Curie actions in the H2020 program.

⁴⁰ The G6 association is made up of the CNR (*Consiglio nazionale delle ricerche*) in Italy, the CNRS, the CSIC (*Consejo superior de investigaciones científicas*) in Spain, the Helmholtz association, the Leibniz association and the MPG in Germany.

VIII. Science in society and overall impact of CNRS

1 / Responsible research

Recommendation 11: Encourage a culture of sustainability, integrity and responsible research

Given the fast-evolving environment of our society, the CNRS should lead by example and articulate a balanced response to public expectations such as sustainability, integrity, ethics, and responsible research.

Sub-recommendations

- 11.1 Propose solutions backed up by rigorous research towards a sustainable future.
- 11.2 Further strengthen research in areas of national and international concern such as climate change, biodiversity decline and AI safety.
- 11.3 Strengthen efforts towards adapting the CNRS organization and operations towards sustainability, including making sure that the CNRS itself is setting a good example, so that its message will be stronger.
- 11.4 Raise awareness at all levels about ethical issues in research and technology.
- 11.5 Make sure the message on scientific integrity gets through at all levels, and define clear action to be taken in the event of violations.

Sustainability, including global challenges such as climate change and the ecological transition, ethical issues in research and innovation, and scientific integrity: these three major topics are essential to sustaining French society's trust in the CNRS and in science in general.

a/ Sustainable future

The global climate and biodiversity crises call for CNRS mobilization. The most obvious response is to put resources into research in those areas, which the CNRS is doing – on climate change, and on the biodiversity decline – through its priority “societal challenges” identified in the COP. Such research falls into two main categories: improving the understanding of climate change, biodiversity and ecosystems, and developing methods for reducing, mitigating, or even reversing the adverse impact that humanity has on the planet. These are areas where scientific breakthroughs could have a hugely positive impact on the world, and the CNRS should do everything possible to develop a research environment in which such breakthroughs are more likely to occur.

In order to have maximum impact, it is not enough to understand the underlying science. It is also essential for scientists to advocate for the changes we need to make in order to minimize these problems, and the CNRS cannot do that effectively unless it leads by example. The CNRS should therefore adapt its organization and operations towards sustainability. It should routinely consider the environmental impact of all its decisions and take steps to reduce it wherever possible. It should have a credible plan for how it will get to net zero emissions, with ambitious intermediate targets.

b/ Ethical issues

The assessment committee observes that some ethical questions seem surprisingly absent from internal discussions within the CNRS. For instance, risk related to artificial intelligence has become a major topic as a result of the rapid introduction of large language models, but has not been considered by the CNRS Ethics committee. The CNRS should surely be at the forefront of these and similar discussions. It should also reinforce its involvement in official bodies and debates on ethical issues related to science and innovation at the national and European levels.

c/ Scientific integrity

Before the creation of the “Mission à l'intégrité scientifique”, much of the activity of the CNRS Ethics committee was concerned with research integrity and cases of scientific misconduct. The “Mission à l'intégrité scientifique” was created in 2018 – following a recommendation of the Ethics committee. The number of cases it has to deal with is large, though half of them are not taken any further because they are outside of its scope, lack evidence, or do not concern CNRS researchers; of the remainder over a third reveal no misconduct. Several awareness

initiatives are in place; for instance, PhD students undergo mandatory training in research integrity, and an online course has recently been set up in partnership with universities.⁴¹

The assessment committee was pleased to observe that the CNRS strengthened its organization and initiatives related to scientific integrity. However, the committee wishes to emphasize that scientific integrity is a topic that deserves the highest attention from the CNRS, and that warrants further reflection to define the most appropriate answers that the CNRS might give when facing delicate situations.

- Transparency in the way allegations of misconduct are treated is a difficult issue. In the CNRS, only a fraction of reported cases of misconduct are made public. Also, the experts consulted are anonymous, to protect them from potentially detrimental repercussions. While this is understandable, the lack of transparency may be problematic, especially for the victims of misconduct; it is also a missed opportunity to spread a culture of zero tolerance for misconduct through the organization.
- Another issue that deserves careful consideration is that of defining an appropriate "scale of sanctions" for the variety of cases of misconduct that may occur within the CNRS.
- More broadly, the CNRS should explore whether it considers that its attention to scientific integrity is limited to the scope of the so-called FFP reference (fabrication, falsification, plagiarism),⁴² or if it instead extends to the full scope of the CNRS missions. Scientific integrity in relations with private companies, and scientific integrity in the dialogue with society, or in bringing scientific expertise to policymakers are also issues that deserve careful attention.

The committee is also pleased to note the increasing attention paid by the CNRS to deontology.

2 / Sharing knowledge with society

Recommendation 12: Enhance knowledge sharing and communication for the benefit of society

The motto of the CNRS, "fundamental research for the benefit of society", calls for a more significant contribution to the development of a well-educated society through the dissemination of knowledge. These contributions should be incentivized, monitored, and appropriately rewarded.

Sub-recommendations

- 12.1 Establish a policy on knowledge transfer for the benefit of society, including the acknowledgement of such responsibility at the highest level and the need to provide resources, training and tools to all Institutes and UMRs.
- 12.2 Include in the researchers' review an evaluation of how their work benefits society.
- 12.3 Strengthen the CNRS presence in non-specialist media in order to explain its contribution to society and global impact.
- 12.4 In the spirit of sustained dialogue with society, enhance communication channels and interactions with the general public and civil society.
- 12.5 Create a general framework to assess the overall impact of the CNRS in all aspects of its contributions to society.

Contributing to "the economic, social and cultural progress of the nation" is part of the core mission statement of the CNRS, written in its decree. Of course, there is no question that ultimately the knowledge generated by CNRS research will benefit society. However, the committee considers that the CNRS current strategy and organizational model do not foster a very dynamic and responsive exchange between CNRS and society at large. It recommends strengthening the CNRS commitment on its contribution to society, by establishing a policy on knowledge transfer for the benefit of society, including the acknowledgement of such responsibility at the highest level. The CNRS should play a leading role in advocating for rationality and in contributing to increasing society's trust in science in France and Europe.

The committee recommends reinforcing CNRS action in several areas:

- The CNRS should strengthen its presence in non-specialist media in order to explain its contribution to society. While it is interesting to develop the outreach of the CNRS website and the CNRS newspaper,

⁴¹ Source: interviews held during the assessment visit.

⁴² Source: SAR.

and to pursue open science as well as scientific outreach initiatives and publications, these means are not exactly reaching the general public.

- The committee suggests enhancing communication channels and interactions with the broader public in the spirit of sustained dialogue with society. As written in the COP, the top-down model of an academic authority that imposes its ideas on relatively uninformed citizens is to be abandoned;⁴³ pedagogy, dialogue and sometimes debate are needed to overcome mistrust and contribute to social issues with humility, high standards and ambition. Strengthening its involvement in the dialogue with society will also allow the CNRS to better identify how to improve and sustain citizens' trust in science. In the same spirit, the committee welcomes the measures put in place by the CNRS to train scientific experts in best practices for dealing with the press and the public in general.⁴⁴ It will be interesting to assess the effectiveness of these measures at a later juncture.
- The committee has not received information on the results of two interesting measures included in the COP for the 2019-2023 period, namely "Create training courses for teachers in the French national education system" and "Enhance partnerships with major cultural institutions".⁴⁵ This type of initiative should be encouraged, and its impact should also be assessed at a later juncture.
- The COP also includes the commitment to develop "*new participatory science initiatives*", but the CNRS seems to have changed its view on participatory science: according to the SAR, it "prefers to take its time" before launching such initiatives in order to avoid the risk of the "instrumentalization of science" and the "emergence of scientific populism".⁴⁶ The committee encourages the CNRS to rapidly clarify its view on this topic; its complete absence from the area of participatory science would be regrettable.
- The "*Mission pour l'expertise scientifique*" (MPES) is a recent initiative designed to provide a framework and support structure to catalyze collective expertise from the CNRS into assessment reports on complex issues for policymakers. It appears to be a nimble, agile initiative, able to respond to emerging problems directly relevant to policy. Because of its recent creation, there is still no evidence that the MPES is directly or indirectly influencing policy or industrial or social practices. It would be important to design ways to monitor such influence in the near future.
- As said in Chapter VI, social innovation is underdeveloped and should be strongly encouraged.

The assessment committee noted that the MPES and "*médiation scientifique*" appear to be secondary activities, organized centrally, and having only a very marginal impact on many researchers' activities. It considers that there is a need to establish a more direct link between CNRS UMRs and society, which would allow them to better respond to society's needs; this could be by choice of research topics, contributions to education, translation into industry, or outreach activities and dialogue with society. Of course, not everyone should be doing everything, and it is important to preserve the long-term view and diversity that characterizes CNRS research; but most – if not all – UMRs should demonstrate real involvement in society. The CNRS should provide resources, training, and tools to all Institutes and UMRs to incentivize this move. The assessment of research units and researchers should account for how their work benefits society.

* * *

While insisting that the purpose of the CNRS is "fundamental research at the service of society", the SAR gives very little information on this "service" to society: what is the CNRS contribution to the nation's wealth, economy, wellness, progress of human beings, etc.? Evaluating the impact of the CNRS on society is difficult, of course, but this evaluation would contribute to having its activities "better perceived in all their richness", as the CNRS wishes,⁴⁷ and to its attractiveness for staff and partners. This is why the committee chooses to repeat here the sub-recommendation already written in Chapter V regarding the CNRS overall impact. **The committee strongly recommends that the CNRS undertake in-depth work on the evaluation – or the measurement – of the impact of its activities in all aspects**, be it the scientific impact – progress of knowledge and influence on scientific work done elsewhere – and the technological impact, the contribution to education, the economic impact, the impact on public policy and for society as a whole, the ethical impact, the environmental impact, the intellectual and cultural impact, etc.

⁴³ Source: COP page 47.

⁴⁴ Source: SAR.

⁴⁵ Sources: COP page 47 and SAR.

⁴⁶ Source: SAR.

⁴⁷ Source: SAR.

Conclusion

This report was produced by an international committee made up of scientists and leaders from the worlds of universities, research organizations, technology transfer offices, and business and industry.

The committee considers the CNRS to be a major and world-class research institution. Its history and impact are reflected in its reputation, its size and scope, and its presence throughout France, in European science initiatives, and internationally. However, the committee believes that the CNRS can do better.

The committee recognizes the uniqueness of the CNRS model, based primarily on the strength of joint research units. UMRs bring together scientists from universities, and other public actors. They have built the CNRS great research capacity, increasing its research strength (from 30,000 CNRS employees in the UMRs to close to 110,000 employees) and also increasing the research strength of the universities and other partners. But they call for transparency, coordination, clear partnership strategies, and shared responsibilities.

Throughout the assessment, several issues of particular importance for the future of the CNRS came to the committee's attention. These can be summarized as follows: updating the CNRS role, governance, development of scientific talent, administrative support, dialogue between society and science, innovation, and the emergence of new research themes.

* * *

The analysis focused on the current situation, the efforts made in recent years by the CNRS and its partners, and the conditions for success in the future. The committee acknowledges the fact that the assessment was conducted in a period of transformation for the French research ecosystem. The evaluation was based on the self-assessment report, the review of numerous documents, multiple exchanges, and interviews with CNRS officers, employees and partners, and visits to university sites.

The committee members reached a consensus, which is a testament to the significant efforts made toward sensible recommendations. The committee understands that its views may be challenged, although it hopes that the CNRS will see the opportunities in implementing the recommendations in accordance with its capacity, culture, and ambitions, all to the benefit of its missions and future, and to the benefit of French research and society.

The committee would like to thank Hcéres for its valuable and comprehensive support throughout the assessment process, from preparation to delivery. It would also like to thank the CNRS leadership team and members for their support in answering questions and providing documentation when requested.

* * *

The following presents a high-level summary of observed strengths and weaknesses of the CNRS, as well as the main recommendations written in this report.

1 / Strengths

- The scientific production;
- The pride of belonging;
- The renown and visibility;
- The size and scope of the scientific capacities;
- The leading position in Europe;
- The enhanced support to technology transfer and innovation;
- The capacity to build partnerships (e.g. universities, national and international research organizations, industry).

2 / Weaknesses

- The governance of the CNRS and the modes of co-operation with partners (e.g. universities, national and international research organizations, industry);
- The approach to developing the talent pool: scientists, engineers, technical and administrative staff.
- The capacity to measure scientific and societal impact;
- The mid- and long-term strategies (e.g. science, Europe, funding, etc.);
- The administrative burden on scientists and engineers;
- The contributions to a well-educated society.

3 / Main recommendations

- | | |
|--------------------------|--|
| Recommendation 1 | Update the role and positioning of the CNRS within the evolving French research ecosystem |
| Recommendation 2 | Modernize the governance of the CNRS and bring it to the level of other world-class research institutions |
| Recommendation 3 | Deploy new strategies for sustained multiannual diversified funding |
| Recommendation 4 | Implement an ambitious strategy to attract, support and retain the best talent |
| Recommendation 5 | Develop a culture of mentoring and inclusion at all levels |
| Recommendation 6 | Deepen the partnership with universities, strengthen the co-management of the UMRs and the involvement of CNRS researchers in education |
| Recommendation 7 | Launch a “commando operation” to respond urgently and decisively to the need to simplify administrative processes and reduce the bureaucratic burden on the CNRS community |
| Recommendation 8 | Strengthen the scientific policy and the partnership strategy, as well as risk taking, and implement regular international expert reviews and benchmarking |
| Recommendation 9 | Accelerate the development of innovation and transfer to society |
| Recommendation 10 | Act as a driving force and source of proposals at the European level |
| Recommendation 11 | Encourage a culture of sustainability, integrity and responsible research |
| Recommendation 12 | Enhance knowledge sharing and communication for the benefit of society |

Appendix: On the ten Institutes of the CNRS

The assessment committee was not asked to assess each of the ten Institutes of the CNRS. However, the *Terms of reference* for the assessment stated that, on a number of key topics (role and positioning, scientific policy, interdisciplinarity, attractiveness, European commitment, etc.), the committee had to not only review the CNRS as a whole, but also to pay attention to the specificities of the field of action of each Institute.

To meet this requirement, the committee made its best efforts to get a real understanding of the CNRS activities and actions in the fields of the 10 Institutes, in particular by asking written questions aimed at collecting a comprehensive set of data on the Institutes' activities. In addition, a meeting with a subgroup of the committee's experts allowing in-depth exchanges with the management team of each Institute was included in the program of the assessment visit to the CNRS. These meetings with the Institutes' management teams have been very helpful – together with visits to university sites – to allow the committee to grasp, to the greatest extent possible, the reality of the CNRS activities; the committee was pleased to note that the Institutes are vibrant and reflect the dynamism and excellence of CNRS research.

The very high diversity of the 10 Institutes is one of the main takeaways from these Institute-level analyses. On the one hand, they are diverse because of the basic specificities of their research fields: not all scientific fields operate in the same way, and “steering” or “coordinating” a set of research units has different meanings, for instance, in the field of “big physics” or in the fields of mathematics or humanities and social sciences. On the other hand, the 10 Institutes are also extremely diverse on other aspects related to their position in the French research ecosystem, their size and organization, the Institute-UMRs relationship, and some key aspects of their “performance”.

This Appendix gives, for each of the 10 Institutes, the values of some key indicators that have been selected by the assessment committee and Hcéres, and it summarizes the main remarks and suggestions made by the committee's experts who examined each Institute.

* * *

The indicators used in this Appendix are as follows:⁴⁸

- “Characterization” indicators:
 - Staff:
 - number of CNRS permanent employees in the Institute;
 - percentage of permanent researchers in the CNRS permanent employees;
 - percentage of women in the CNRS permanent employees ;
 - Weight and position in France:
 - percentage of the CNRS permanent staff in the total permanent staff of the UMRs of the Institute;
 - national share of the CNRS UMRs with respect to the French research ecosystem in the field of the Institute (estimate);⁴⁹
 - number of national research organizations mainly involved in the field of the Institute;⁵⁰
 - Research units:⁵¹
 - number of research units of the Institute;
 - average number of CNRS permanent staff in each research unit of the Institute;
- “Performance” indicators:
 - Participation in ERC:
 - ratio of the number of ERC projects submitted by CNRS permanent researchers in the 2014-2020 period to the number of CNRS permanent researchers;
 - success rate of these ERC submissions;
 - International recruitment:
 - percentage of non-French scientists in the Institute's newly hired permanent researchers (2017-2021);
 - percentage of non-French scientists in the PhD students and post-docs hired in the Institute (2022);
 - DOR meetings:
 - ratio of the average annual number of “Dialogue on objectives and resources” meetings in the 2017-2021 period to the number of research units of the Institute.

⁴⁸ Unless otherwise specified, the source for the indicators' values is the CNRS written answers to written questions of the assessment committee.

⁴⁹ Share of the CNRS UMRs in the French publications over the 2017-2021 period. See <https://bit.ly/2023-analysis-scientific-technological-profile-CNRS>.

⁵⁰ Source: Hcéres.

⁵¹ On December 31, 2021.

Before examining these indicators for each Institute, the first table below gives their values for the CNRS as a whole, and the second table shows the lowest Institute's value and the highest Institute's value for each indicator.

Characterization indicators for the CNRS as a whole		
Staff	Number of CNRS permanent employees in the UMRs	21,490
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	50%
	% women in the CNRS permanent employees in the UMRs	40%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	32%
	Weight of the CNRS UMRs in France	43%
	Number of national research organizations	≈ 15
Research units	Number of research units	1,056
	Average number of CNRS permanent employees per research unit	20
Performance indicators for the CNRS as a whole		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	22%
	Success rate	20%
International recruitment	% non-French scientists in the recruitment of permanent researchers	29%
	% non-French scientists in the recruitment of PhD students and post-docs	28%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 17%

Characterization indicators: lowest and highest Institute values		
Staff	Number of CNRS permanent employees	633 // 4,446
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	29% // 66%
	% women in the CNRS permanent employees	27% // 56%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	17% // 73%
	Weight of the CNRS UMRs in the field in France	≈ 28% // ≈ 77%
	Number of national research organizations mainly involved in the field	0 // 4
Research units	Number of research units	19 // 279
	Average number of CNRS permanent employees per research unit	11 // 89
Performance indicators: lowest and highest Institute values		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	15% // 36%
	Success rate	13% // 34%
International recruitment	% non-French scientists in the recruitment of permanent researchers	15% // 36%
	% non-French scientists in the recruitment of PhD students and post-docs	17% // 47%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 4% // 100%

The great diversity of the 10 Institutes – not to say the strong contrast between them – is visible on all aspects measured by the key indicators, be it:

- for the size of their workforce, and for the balance between permanent researchers and permanent support staff as well as the gender balance;
- for the weight of the CNRS staff in the Institute's UMRs, and for the Institute's weight and position in the French research ecosystem;
- for the number of research units attached to the Institute, and for their average size;
- for the commitment to participating in ERC projects, and for the success rate in securing ERC grants;
- for the attractiveness to non-French scientists;
- and for the ability to hold regular "Dialogue on objectives and resources" meetings with the UMRs.

Hereafter, in the tables that give the indicators' values for each Institute, the values of the performance indicators are written in green (respectively: red) if the performance of an Institute is above (resp.: below) the CNRS average. In the same spirit, the values of some of the characterization indicators are also written in green or red when they substantially diverge from the CNRS average value. Last, histograms giving a graphical representation of the indicators' values are presented at the end of this Appendix.

1 / National Institute of nuclear physics and particle physics (IN2P3)

a/ Key indicators

Characterization indicators for IN2P3		
Staff	Number of CNRS permanent employees	1,699
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	29%
	% women in the CNRS permanent employees	27%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	73%
	Weight of the CNRS UMRs in the field in France	≈ 77%
	Number of national research organizations mainly involved in the field	1 ⁵²
Research units	Number of research units	19
	Average number of CNRS permanent employees per research unit	89
Performance indicators for IN2P3		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	16%
	Success rate	15%
International recruitment	% non-French scientists in the recruitment of permanent researchers	35%
	% non-French scientists in the recruitment of PhD students and post-docs	43%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	100%

b/ Remarks and suggestions

The *Institut national de physique nucléaire et de physique des particules* (IN2P3) conducts cutting-edge research in fundamental physics at a level that is second to none on the international stage. The team has clarity of mission and carries out their mandate of national coordination through a collaborative network of regionally aggregated centers.

IN2P3 probes the basic understanding of the fundamental properties of matter and the nature of the accompanying interactions at both the smallest and the largest length scales, using accelerators and non-accelerator methods, as well as astrophysical observations. This involves the construction, operation, and exploitation of large scientific facilities (CERN being perhaps the best-known example), often in cooperation with international partners. This gives the science done within this Institute a distinct character. The long life cycle of these large facilities requires an extended process of design and construction, and demands effective technical project management capabilities in addition to the foundational engineering and scientific talent at the individual level.

The committee's experts applaud the inclusive and thoughtful priority-setting process that is undertaken by IN2P3 leadership in order to select which projects to pursue; this prioritization process exhibits the best practices seen at the international level. They also welcome the yearly meetings with universities to coordinate education and maintain a pipeline of talent. This is high-stakes, big-team science that demands collaboration and cooperation among individual people, teams, institutions, and nations. France is seen as an international leader in this area. Two specific indicators of this are: 1) the strong and disproportionate leadership role that French members play in the governance of large experiments at CERN, and 2) the fact that France was approached by the USA as the main international partner for the construction of the instrument for the Rubin Observatory, which is the largest current US investment in ground-based optical astronomy. These facts illustrate the scientific and technical strengths of IN2P3.

The committee's experts offer a few suggestions for consideration by IN2P3 management that might make an outstanding research Institute even stronger. First, they encourage the Institute's leadership to work with CNRS management to identify potential ways of strengthening and streamlining the regional administrative services that are provided to IN2P3 research units, research groups, and individuals. This could include i) giving IN2P3 clients a voice in performance evaluations for service centers, and/or ii) quarterly tracking of levels of service received using metrics such as request-to-delivery times for procurements and turnaround times for human resource activities. The experts also suggest that IN2P3 commit to conducting periodic external reviews at the Institute level.

⁵² CEA (Commissariat à l'énergie atomique et aux énergies alternatives: Alternative energies and atomic energy commission).

2 / Institute of chemistry (INC)

a/ Key indicators

Characterization indicators for INC		
Staff	Number of CNRS permanent employees	2,951
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	52%
	% women in the CNRS permanent employees	40%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	38%
	Weight of the CNRS UMRs in the field in France	≈ 62%
	Number of national research organizations mainly involved in the field	0
Research units	Number of research units	144
	Average number of CNRS permanent employees per research unit	20
Performance indicators for INC		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	22%
	Success rate	17%
International recruitment	% non-French scientists in the recruitment of permanent researchers	31%
	% non-French scientists in the recruitment of PhD students and post-docs	37%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 15%

b/ Remarks and suggestions

During the meeting with the committee's experts, INC management engaged in a highly constructive discussion. According to INC, the CNRS contributes 9% of the total budget for research activities (excluding permanent staff salaries and structural costs), universities contribute 8%, and contracts account for 83% of the total funding (€322 million). This demonstrates the dynamism of INC's research units.

INC initiatives impressed the committee's experts:

- The "Itinérance" program attracts scientists from fields other than chemistry, fostering interdisciplinary collaboration and innovation.
- The "Emergence" and "Emergence International" programs support relatively new faculty members. They offer resources and opportunities for early-career researchers to establish themselves and be internationally recognized in their respective fields.
- Another noteworthy initiative is the "Convergence@INC" program. This program aims to support and promote emerging and exciting research areas within chemistry. Additionally, it serves as a mechanism to assist researchers facing challenging situations.

Most of these programs have been developed by INC and are considered unique within the CNRS. The committee's experts highly encourage these initiatives, recognizing their significance and potential for driving scientific advancements within the field of chemistry.

One of the issues raised by the committee's experts in the meeting was the relatively low success rate of researchers from INC in obtaining ERC Starting grants. To address this concern, INC management has implemented several initiatives. One of them involves funding external assistance to enhance the quality of research proposals; this support aims to help researchers improve their proposals and increase their chances of securing ERC grants. Furthermore, INC has recognized the importance of adequately preparing researchers for the ERC interview process. It has introduced a program that allows researchers to conduct mock interviews in realistic conditions. This preparation can significantly improve researchers' confidence and performance during ERC interviews.

The committee's experts greatly appreciated the interdisciplinary research collaborations between INC and other Institutes. They recognized the value of strengthening collaborations between chemistry and health, as well as chemistry and biology. The experts emphasize the importance of bolstering interdisciplinary research collaborations, particularly in the areas mentioned above. They raise a significant concern regarding losing researcher positions at INC when researchers move to different Institutes. To counter this situation, the CNRS management must implement measures to avoid the loss of researcher positions at INC due to transfers to other Institutes.

3 / Institute of ecology and Environment (INEE)

a/ Key indicators

Characterization indicators for INEE		
Staff	Number of CNRS permanent employees	1,332
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	52%
	% women in the CNRS permanent employees	46%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	28%
	Weight of the CNRS UMRs in the field in France	≈ 44%
	Number of national research organizations mainly involved in the field	4 ⁵³
Research units	Number of research units	78
	Average number of CNRS permanent employees per research unit	17
Performance indicators for INEE		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	23%
	Success rate	19%
International recruitment	% non-French scientists in the recruitment of permanent researchers	15%
	% non-French scientists in the recruitment of PhD students and post-docs	17%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 15%

b/ Remarks and suggestions

The committee's experts identify INEE's main strengths as follows:

- A cohesive institution with a strong sense of belonging.
INEE appears as a strong, vibrant, well-articulated institution. It has developed rich networks connecting labs and connecting researchers at different stages of their careers, and also bringing labs closer to local communities. INEE actively promotes teamwork and cultivates a sense of community. Collective resources (e.g. interactions, shared facilities, etc.) are seen as one of their most important assets.
- A clear, participatory strategy.
The general scientific strategy appears clear and focused. It is defined every few years through a roadmap construction exercise, with the active involvement of all researchers both from INEE and the wider French community.
- Robust scientific and interdisciplinary outputs.
INEE has a strong presence in the international peer-reviewed literature, and it considers this to be at the core of its mission. In recent years they have become committed to building strong networks with local stakeholders in the different regions of France. This includes a growing number of networks, task forces and liaison activities between labs that are pursued with high commitment and enthusiasm.
- Synergistic links with universities.
The INEE leadership team sees the links with universities – through UMRs – as a win-win strategy in terms of research and teaching, rather than a burden or overlap.

The committee's experts also highlight some major challenges that INEE will face in the coming years.

- Better public and decision-making outreach.
Despite substantial progress in the past few years in terms of public outreach, INEE would like to invest more resources in training for better communication with civil society. INEE also identifies a need to be more involved in decision making and to incorporate scientific views more deeply into the decision-making process.
- Deepen and better communicate on innovation relevant to the society at large.
Involvement in "traditional" technological innovation remains limited and should be reinforced. However, in accordance with the scientific inclinations of its researchers, INEE is achieving a growing presence in social innovation and initiatives with civil society. This includes for instance social, urban planning and environmental initiatives, educational programs, nature-based solutions, environmental biotechnology, the ecology of harvested wild populations, bioremediation, etc. This needs to be expanded and communicated on to the public and policymakers in a more prominent way.
- Strong need for qualified permanent support staff.
The lack of permanent positions for engineers and technicians appears to be hampering progress and jeopardizing the legacy of some units. This puts excessive pressure on existing support staff and greatly increases the risk of losing scientific infrastructure and other strategic assets.

⁵³ Ifremer (*Institut français de recherche pour l'exploitation de la mer*: French research institute for the exploitation of the sea), INRAE (*Institut national de recherche pour l'agriculture, l'alimentation et l'environnement*: French national research institute for agriculture, food and the Environment), IRD (*Institut de recherche pour le développement*: French national research institute for sustainable development), MNHN (*Muséum national d'histoire naturelle*).

4 / Institute of physics (INP)

a/ Key indicators

Characterization indicators for INP		
Staff	Number of CNRS permanent employees	2,190
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	55%
	% women in the CNRS permanent employees	27%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	49%
	Weight of the CNRS UMRs in the field in France	≈ 67%
	Number of national research organizations mainly involved in the field	1 ⁵⁴
Research units	Number of research units	67
	Average number of CNRS permanent employees per research unit	33
Performance indicators for INP		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	36%
	Success rate	21%
International recruitment	% non-French scientists in the recruitment of permanent researchers	32%
	% non-French scientists in the recruitment of PhD students and post-docs	46%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 33%

b/ Remarks and suggestions

INP is home to scientific research communities covering a large range of disciplines, from the study of matter, from single atoms to complex solids, radiation and all its interactions with matter, and the fundamental laws that govern the physical world. This research is conducted in a very broad way, as it comprises theory, through pure mathematical tools or numerical approaches, as well as experiments, from bench-top to large infrastructure. INP structures its activities along six different themes: i) theoretical physics, modelling and numerical simulations; ii) optics, atoms, molecules and quantum physics; iii) condensed matter, materials and nanoscience; iv) states of matter, phase transitions, instabilities and disorder; v) lasers and plasma; vi) physics of living matter.

INP research has often a pluridisciplinary aspect, in connection with IN2P3, INSU and INSIS for particle physics, astrophysics and system engineering, but also with INSMI (mathematics), INC (chemistry) and INSB (biology). INP uses the different tools at its disposal to make sure that pluridisciplinary research is fostered and supported. Another important feature of INP is the management of large research infrastructures such as synchrotrons, nanotechnology fabrication platforms, and very high-power lasers in national and international collaborations.

In many important topics such as quantum technologies or solid-state matter, INP research units have reached a level of international excellence which is second to none. INP can pride itself in counting 4 Nobel Prize laureates among its fold and having had a very strong impact internationally.

The committee's experts commend INP for having started a complete bottom-up strategy process that should be completed soon; such a process should be performed regularly and used as an input for the strategy of the CNRS as a whole. The experts also offer a few suggestions for consideration by INP management that might make an outstanding research Institute even stronger.

- First, they encourage INP leadership to work with CNRS leadership to implement a more modern and high-level approach to resource management, including a long-term financial plan. INP is also encouraged to consider implementing programs that have been successfully deployed by other Institutes for the support of young researchers.
- INP could also support CNRS leadership in its efforts to decrease the administrative burden through quarterly tracking of levels of service received using metrics such as request-to-delivery times for procurements and turnaround times for human resource activities. It is also suggested that INP commit to conducting periodic external reviews at the Institute level.
- It is clear that quite some value is created in INP that can be translated into industrial impact and innovation in the broader sense. INP should build a strong relationship, transparency on the pipeline of opportunities, targets for innovation and tech transfer with the CNRS innovation departments, and have a clear service level agreement (response time, specific terms of service, etc.) in place.
- There are excellent examples of joint labs with industry in the INP setting. It warrants a focused effort to bring together the best practices from all INP teams and to share these findings widely in the CNRS. It would also be interesting to discuss whether the potential for innovation and the technological impact are fully exploited in the situation of a joint lab with one industry player, what the track-record is in terms of openness and how to monitor it.

⁵⁴ CEA.

5 / Institute for information sciences and their interactions (INS2I)

a/ Key indicators

Characterization indicators for INS2I		
Staff	Number of CNRS permanent employees	1,046
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	57%
	% women in the CNRS permanent employees	30%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	20%
	Weight of the CNRS UMRs in the field in France	≈ 47%
	Number of national research organizations mainly involved in the field	2 ⁵⁵
Research units	Number of research units	40
	Average number of CNRS permanent employees per research unit	26
Performance indicators for INS2I		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	20%
	Success rate	13%
International recruitment	% non-French scientists in the recruitment of permanent researchers	36%
	% non-French scientists in the recruitment of PhD students and post-docs	38%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 50%

b/ Remarks and suggestions

INS2I is one of the smallest and most recent Institutes. Research is organized by theme into research networks, i.e. sub-organizations that cut across laboratories. INS2I appears to be a well-working Institute that is positioned well within the CNRS. It is involved in multiple collaborations both in the CNRS and outside. Innovation culture seems to be widely developed within INS2I: researchers welcome the flexibility offered to startup founders, and specifically the possibility of keeping a part-time position at CNRS while creating a company.

However, the committee's experts noted some difficulties or challenges that deserve particular attention:

- INS2I is mainly seen by some actors as a provider of computational resources and software.
- Some goals or activities of INS2I overlap with Inria, which seems to be the source of some tension, although INS2I management has a regular communication channel with Inria leadership.
- Access to large-scale computing infrastructures (e.g. for training large machine-learning (ML) models) is not always adequate.
- It appears to be challenging to attract highly-qualified technical staff and engineers, many of whom have other more lucrative career opportunities in the industry.
- Current efforts put in place across the CNRS to encourage and measure innovation and impact do not necessarily work well for open-source software projects in which many INS2I researchers are involved.
- Given the speed at which some computer science fields evolve (e.g. AI and ML), the current structures and practices for identifying emerging research topics and investing in them seem to be too slow.

The experts' main suggestions are as follows:

- Better define the role and position of INS2I with respect to Inria and structure their complementarity at the leadership level and at the operational level.
- Conduct a detailed and independent analysis of INS2I's impact, including bibliometric analysis accounting for the specifics of the field (e.g., importance of conference publications).
- Examine current innovation practices and KPIs within the CNRS and determine whether they are suitable for the full spectrum of innovation in the field of computer science such as open-source software.
- In line with the rest of the CNRS, encourage senior researchers at INS2I to apply for ERC Advanced grants and provide them with assistance in preparing their proposal and interview.

⁵⁵ CEA and Inria (*Institut national de recherche en sciences et technologies du numérique*: French research institute in digital science and technology).

6 / Institute of biological sciences (INSB)

a/ Key indicators

Characterization indicators for INSB		
Staff	Number of CNRS permanent employees	4,446
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	51%
	% women in the CNRS permanent employees	52%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	33%
	Weight of the CNRS UMRs in the field in France	≈ 31%
	Number of national research organizations mainly involved in the field	1 ⁵⁶
Research units	Number of research units	184
	Average number of CNRS permanent employees per research unit	24
Performance indicators for INSB		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	21%
	Success rate	22%
International recruitment	% non-French scientists in the recruitment of permanent researchers	32%
	% non-French scientists in the recruitment of PhD students and post-docs	33%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 12%

b/ Remarks and suggestions

INSB is the largest CNRS Institute, with 2,249 permanent CNRS researchers and almost as many permanent supporting staff. The Institute is spread over 16 locations, is home to 184 UMRs and covers all aspects of biology including structural biology, genome organization and expression, cell biology, development and evolution, plant biology, immunology, pharmacology, bio-engineering and imaging. The focus is on fundamental research and on seeking to achieve a mechanistic understanding. The committee's experts are thankful for the open dialogue engaged in with INSB management, which centered around how to run an Institute with such a complicated structure, junior researchers, mentoring, and how priorities and new research themes can be established.

To cope with the large number of sites and units, a substructure with ten deputy scientific directors has been established; eight deputy directors cover 8 fields in biology, and two oversee the technology platforms and infrastructures and are responsible for site coordination. UMRs cover a wide range of sizes, with some as large as 600 persons while a UMR with around 200 persons is considered ideal. In the future, INSB should strive for UMRs which have a strong CNRS-dominated research focus, which tackle specific problems, have a perspective for future strategic development, allow development of a common culture and result in higher visibility. INSB highlights that the attraction of the UMRs is the collaboration with university professors and the facilitated access to students.

A successful close collaboration has been established with Inserm in the area of medicine, including the joint selection of 10 junior researchers per year via the ATIP program. As a very positive sign, some young INSB researchers are also recruited via the ATIP and tenure track programs. This gives the Institute the chance to select the best talent in newly emerging areas or areas which they would like to strengthen. In addition, the ATIP program, which comes with substantial support, guarantees independence of those selected right from the beginning. The committee's experts consider this aspect to be of growing importance: these positions should be made internationally competitive to attract the most innovative young researchers.

A mentoring structure for CRs (*chargés de recherche*) has been established with checkpoints in the second and seventh years after appointment, including teambuilding activities and one-to-one discussions with the director. However, there is no continuous mentoring after 7 years, despite the fact that this period has become critical to gaining scientific independence and coincides with the period during which it becomes possible to apply for a DR position. In addition, the evaluation of the continued scientific excellence of the research conducted by INSB researchers is challenging, as they usually work in large teams within a UMR. The individual evaluation conducted every 2.5 years by the National committee for scientific research appeared to the committee's experts to be a mere formality, given its 98% positive outcome. In the experts' view, the scientific excellence of individual researchers should be regularly evaluated via expert international committees who simultaneously give advice.

⁵⁶ Inserm (*Institut national de la santé et de la recherche médicale*: French national institute for health and medical research).

7 / Institute for humanities and social sciences (INSHS)

a/ Key indicators

Characterization indicators for INSHS		
Staff	Number of CNRS permanent employees	3,007
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	56%
	% women in the CNRS permanent employees	56%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	36%
	Weight of the CNRS UMRs in the field in France	≈ 28%
	Number of national research organizations mainly involved in the field	0
Research units	Number of research units	279
	Average number of CNRS permanent employees per research unit	11
Performance indicators for INSHS		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	15%
	Success rate	13%
International recruitment	% non-French scientists in the recruitment of permanent researchers	23%
	% non-French scientists in the recruitment of PhD students and post-docs	32%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 4%

b/ Remarks and suggestions

During the meeting with the committee's experts, INSHS highlighted the main priorities of its activities.

- INSHS plays a key role in providing and operating infrastructures for the entire French research community in social sciences and humanities, including support for the OpenEdition platform of books and journals, for the digital humanities (HumaNum), and for social science data (Progedo).
- Related initiatives concern open science, in terms of both increasing open-access publications and strengthening efforts on long-lasting databases for open data.
- Strong emphasis is also placed on research internationalization, with efforts to promote European and international cooperation, support for international mobility, support for increasing publications in English, etc.
- Strengthening collective research is a long-term objective, since progressively shifting the balance between individual research traditions and more collective projects is slow.
- Reinforcing public outreach is another priority, including both real and virtual exhibitions.
- Innovation is also a priority of INSHS, with a variety of initiatives: common research structures and research contracts with private companies, dissemination of open-source software, etc. INSHS is proactive in social innovation, with the objective of answering new or poorly satisfied social needs using participatory methodologies while relying on technologies, methods and know-how.
- INSHS promotes interdisciplinary research not only among its disciplines but also with other CNRS Institutes. Around 100 INSHS researchers work in or with labs attached to other Institutes, primarily INEE (in archeology and environmental research), INS2I (mostly on "decision sciences") and INSB (mostly on education, psychology, linguistics, and cognitive sciences). Moreover, INSHS intends to set up "scientific observatories" on topics such as climate change and educational inequality.

The committee's experts welcome these priorities and encourage INSHS to resolutely pursue these initiatives. They are pleased to note that clear impact can already be recorded for some of these priorities.

The experts noted three HR issues that deserve close attention from INSHS and the CNRS:

- INSHS has lost 11% of its support staff between 2012 and 2020. This loss is regrettable, and the experts note that a clear explanation does not seem to be available. The above recommendations of the committee on achieving to a more agile and responsive administration and creating conditions to better retain support staff certainly apply in the fields covered by INSHS. However, this substantial loss also raises a question at the CNRS level concerning the allocation of support staff positions between Institutes.
- The time interval between recruitment as *chargé de recherche* and access to a *directeur de recherche* position appears to be long in the fields covered by INSHS, but with wide variability (less for economists, more for archaeologists). More regular academic advising of *chargés de recherche* (in addition to the present mentoring meetings at 3 and 7 years) would certainly help reduce the time to promotion.
- INSHS says that it has a high number of CNRS researchers teaching at universities – but no measure of this effort seems to be available. It also has a high number (around 250 each year) of university professors hosted by the CNRS ("*en délégation*"). The experts suggest ironing out the procedures for CNRS researchers to teach at universities and for professors to be hosted at the INSHS.

The experts also observed some difficult or challenging issues and offer the following remarks or suggestions:

- The efforts made to adapt INSHS research to the system of research financed by public grants should be resolutely pursued, be it at the national level (participation in ANR projects) or at the European level (ERC projects and collaborative projects).
- Initiatives that aim to extend the horizon for long-term perspectives and planning are also to be encouraged. Processes for collective decision-making about research priorities should be developed, and a small but guaranteed long-term (10 years) fund for high risk/high reward projects would be useful.
- The experts recommend that INSHS strengthen interactions with partner universities.
- Developing an appropriate bibliometric approach for measuring the scientific production of INSHS UMRs remains a challenging issue.
- The above key indicators show that INSHS is in a singular position in several respects. On the one hand, there is no other national research organization that plays a key role in the fields covered by INSHS, but INSHS is also the CNRS Institute whose UMRs have the smallest weight in the French research ecosystem. On the other hand, INSHS has – by far, among all Institutes – the highest number of research units and the lowest average number of CNRS permanent staff members per unit. These key aspects of INSHS position certainly deserve particular attention.

8 / Institute for engineering and systems sciences (INSIS)

a/ Key indicators

Characterization indicators for INSIS		
Staff	Number of CNRS permanent employees	1,812
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	59%
	% women in the CNRS permanent employees	28%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	20%
	Weight of the CNRS UMRs in the field in France	≈ 55%
	Number of national research organizations mainly involved in the field	0
Research units	Number of research units	106
	Average number of CNRS permanent employees per research unit	17
Performance indicators for INSIS		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	27%
	Success rate	17%
International recruitment	% non-French scientists in the recruitment of permanent researchers	36%
	% non-French scientists in the recruitment of PhD students and post-docs	47%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 16%

b/ Remarks and suggestions

INSIS is home to scientific research communities covering an extremely large array of disciplines. These range from the study of electronics to photonics, nanotechnologies, automation and robotics, materials and structures, fluidics, engineering process, and bioengineering. The way this research is carried out at INSIS is very broad, as it comprises both theory and experiments, from bench-top to large infrastructure. The domains of application are very wide too: transport, energy and Environment, health, construction instrumentation and control, defense, and security. INSIS also focuses on two key subjects for the future of society: climate change and bio-engineering.

INSIS is a well-structured organization with three scientific branches but also with a strong emphasis on transversal matters, interdisciplinarity and cooperation with other research Institutes and industry. It operates 40 research networks; 14% of INSIS permanent staff are working in units attached to other Institutes; 150 research facilities are open to academia and industry, INSIS also has a very substantial track record in terms of innovation and relations with private companies: around 150 patents applications filed each year, around 30 software registrations per year, 20 to 25 startup creations per year, and 155 joint labs with industry. The committee's experts were also pleased to note that 90% of INSIS PhDs find jobs in industry.

The committee's experts also observed some challenging issues and offer the following remarks and suggestions:

- INSIS has begun a strategic exercise on research priorities for the next decade. This initiative should be strongly encouraged, not only to focus efforts on societal priorities coherent with COP objectives, but also as an argument to achieve multiyear (3 to 5 years) perspective on budgeting. This strategic plan should be revised every 3 years.
- INSIS management is aware that a substantial increase in research project funding is needed in the coming years. A dedicated action plan should be established, with several targets: France 2030

programs, ANR, industry, the EU, etc. Particular efforts should be undertaken at the European level, for ERC projects (with special attention to the Advanced grant level) and for collaborative projects.

- Bureaucracy and centralization remain a significant issue, and many decisions could be delegated to UMR or regional levels.
- HR operational management – as opposed to administrative management – should be strongly reinforced, in particular to take care of young researchers and give them career perspectives.
- INSIS should resolutely continue to pursue its contacts with industry at the national level – with a contact point in each UMR and at regional level – and on the European and international scales. A strategy of portfolio management and value creation should be developed.
- The experts suggest developing systematic evaluation of the impact of INSIS's work on society, and communicating on this impact.

9 / National Institute for mathematical sciences and their interactions (INSMI)

a/ Key indicators

Characterization indicators for INSMI		
Staff	Number of CNRS permanent employees	633
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	66%
	% women in the CNRS permanent employees	32%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	17%
	Weight of the CNRS UMRs in the field in France	≈ 74%
	Number of national research organizations mainly involved in the field	1 ⁵⁷
Research units	Number of research units	49
	Average number of CNRS permanent employees per research unit	13
Performance indicators for INSMI		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	24%
	Success rate	34%
International recruitment	% non-French scientists in the recruitment of permanent researchers	35%
	% non-French scientists in the recruitment of PhD students and post-docs	38%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 40%

b/ Remarks and suggestions

France has an extraordinary mathematical tradition that dates back several centuries, which has produced a remarkable number of the world's greatest mathematicians. In recent decades, the CNRS has played a substantial role in perpetuating this tradition, identifying and fostering the brightest young mathematicians and helping them to develop into world leaders. This is a role of which it can be extremely proud.

INSMI is one of the smallest of the ten Institutes, and it has various atypical features. It is one of three of the Institutes to have national status, which is clearly greatly valued. This requires INSMI to think about mathematics in all of France and not just in the framework of the CNRS, a role it shares to some extent with Inria and with the universities.

The career structure for CNRS researchers in mathematics is not like that of most CNRS researchers, because it is much more common for mathematicians to begin their career as a *chargé de recherche* (CR) and then to be promoted to a position as a full professor at a university. This switch is an attractive option, despite the heavy teaching load, since recruitment as university professor is significantly faster than as *directeur/directrice de recherche*. In many ways this is an excellent system: mathematicians get the chance to build their research profile while still young, and once they become more established, they give something back through their teaching, helping to develop the talent of the next generation.

However, the committee's experts were repeatedly told that this system is breaking down, owing to a reduction in the number of professorship positions and to tempting salaries outside academia. Since universities were given more autonomy and decided to prioritize other areas, 250 *maître de conférences* or *professeur* positions have been lost in mathematics. This seems like an unfortunate development, and while it is not obvious what the CNRS can do to halt it, they should be aware that it is a problem and do what they can to persuade universities to employ more mathematicians at the professorial level. Pure mathematics has particularly suffered, but it may be hard to remedy this, as there is a strong reluctance to acknowledge any meaningful distinction between pure and applied mathematics.

⁵⁷ Inria.

Another stress factor affecting the system is a long-standing tradition of requiring mathematicians to change universities when they are promoted (whether to a professorship or to a position as a *directeur/directrice de recherche*). This has clear scientific benefits, as it brings together mathematicians from different backgrounds, helps to ensure that mathematics remains strong throughout France rather than becoming too dominated by one or two large cities, and creates a more cohesive national network of mathematicians. However, these benefits come at a cost. Many mathematicians, when they are promoted, are also at a stage of life where moving is not easy: they may have a young family, a spouse who is not in a position to move, parents or disabled relatives in need of care, and so on. This is not just a theoretical problem. Indeed, the experts heard of cases where this policy has caused people serious difficulties and were also told that some people deliberately do not apply for promotion in order to avoid having to move. It also seems likely that certain groups will be more adversely affected by the policy than others, and therefore that the policy is indirectly discriminatory; for example, women may well on average find it harder to move than men. While the experts do not have figures to make a definitive claim of this kind, they recommend that INSMI look more closely at who is most affected by the policy and consider whether the right balance of scientific benefit and human cost has been achieved.

Mathematics has a worldwide problem with gender balance, and this problem manifests itself in INSMI as well. There has been progress, but it has been very slow, so it is likely that a more active approach is needed. INSMI management mentioned a recommendation by the *Assises des Mathématiques* to create 100 new PhD positions, of which 50 would go to women and 50 to men. The experts recommend that CNRS support this proposal, which would have many other benefits. However, it is also important to support women (and indeed all researchers) once they are in position, and if they are less well represented at more senior levels, to try to understand the factors that cause this. It is notable that the formal mentoring scheme for CRs that exists in the Institute is very limited: a half-hour meeting after one, three, and six years. While it is to be hoped that less formal mentoring takes place as a result of everyday contact with colleagues, the current system does appear to leave room for researchers' personal and professional difficulties to go unnoticed for a long time. The experts recommend redoubling efforts in this area.

10 / National Institute for Earth and space sciences (INSU)

a/ Key indicators

Characterization indicators for INSU		
Staff	Number of CNRS permanent employees	2,374
	% CNRS permanent researchers / CNRS permanent employees in the UMRs	40%
	% women in the CNRS permanent employees	34%
Weight and position	Weight of the CNRS in the UMRs: % CNRS permanent staff / all permanent staff	29%
	Weight of the CNRS UMRs in the field in France	≈ 65%
	Number of national research organizations mainly involved in the field	3 ⁵⁸
Research units	Number of research units	90
	Average number of CNRS permanent employees per research unit	26
Performance indicators for INSU		
Participation in ERC	Ratio of the number of ERC proposals in the 2014-2020 period to the number of CNRS permanent researchers	21%
	Success rate	24%
International recruitment	% non-French scientists in the recruitment of permanent researchers	21%
	% non-French scientists in the recruitment of PhD students and post-docs	40%
DOR meetings	Ratio of the average annual number of "Dialogue on objectives and resources" in the 2017-2021 period to the number of research units	≈ 18%

b/ Remarks and suggestions

INSU comprises an impressive group of scientists, engineers, and technical and administrative staff spanning a wide range of research centers and facilities, including telescopes, astronomical and Earth-science laboratories, and participation in satellite projects. The committee's experts were impressed with the scientific and technical capabilities that could be brought to bear on the CNRS research mission.

Sustaining the technical infrastructure is important to ensure that INSU continues to be seen as a valued partner in satellite projects. The experts note in particular that INSU is the natural linkage point between the CNRS and ESA, NASA, and other international satellite projects. Remote sensing will play an ever-increasing role in monitoring the Earth as we adapt to climate change. Missions that probe the solar system can inform the understanding of the origins of life. Space-based observatories can address the fundamental open questions of

⁵⁸ BRGM (*Bureau de recherches géologiques et minières*; French geological survey), Cnes (*Centre national d'études spatiales*; French national space agency) and Ifremer (*Institut français de recherche pour l'exploitation de la mer*; French research institute for the exploitation of the sea).

dark matter, dark energy, and the evolution of stars, galaxies, and planets. INSU plays a vital role in French participation in these cutting-edge research projects.

One performance benchmark provided by the Nature Index of high-impact publications is to compare the number of articles per year that include an author with an INSU affiliation to those who have a NASA affiliation. Those numbers are 364 and 568, respectively, for the past year. This gives a very rough and, according to the experts' assessment, very positive indication of the strength and scale of the INSU program in space-related activities.

INSU is involved in Earth sciences, in three domains: ocean-atmosphere, solid Earth, and surfaces and continental interfaces. In all three domains, INSU operates federative structures designed to pool observation and modeling platforms, and to promote interdisciplinary activities and exchanges with the non-academic community. An important role is played by the *observatoires des sciences de l'univers* (OSU) which are key actors in the implementation of INSU's national strategy in their regional ecosystems; they oversee many national observation services and promote access to major research equipment and infrastructure.

Research in the field of Earth sciences is fully incorporated into the European research landscape (monitoring networks, space missions, H2020 projects, etc.) and in major international programs like the Intergovernmental panel on climate change (IPCC). On the whole, the involvement of INSU in national and international networks and programs and the world-class recognition of some research units underscore the international influence of INSU, especially in oceanography and atmospheric sciences. Its recognition, its organizational model and its national missions enable INSU to play a key role in offering expertise and support for public decision-making and providing information and expertise for public debates and controversies.

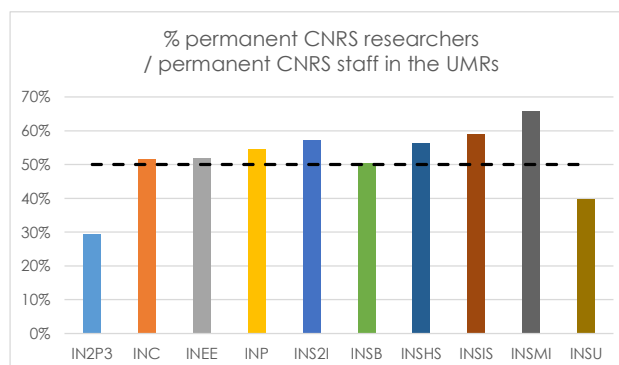
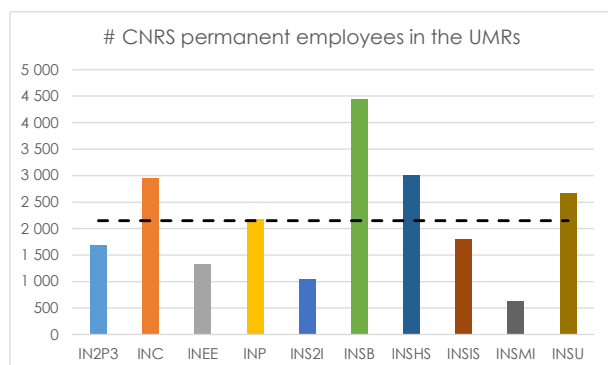
The experts encourage INSU to continue on the path to open-access science, where data from large and important observation programs is made readily accessible to the community. A related issue is public education and outreach. INSU is directly engaged in implementing the CNRS motto "science for the public good", by informing domestic policy-makers and by educating the French and European public about climate-change issues. The experts recommend strengthening the relationship between INSU and the central CNRS structure in this important domain.

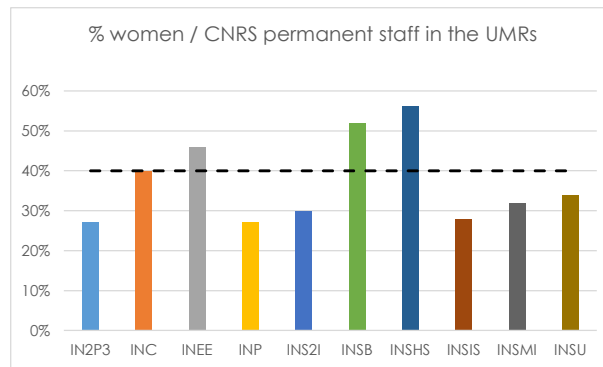
The stress factors regarding workforce, talent recruitment, mentoring, staff retention, and administrative burdens, as described above in the assessment report, do affect INSU, and the committee's recommendations on those issues are applicable here as well.

11 / Histograms

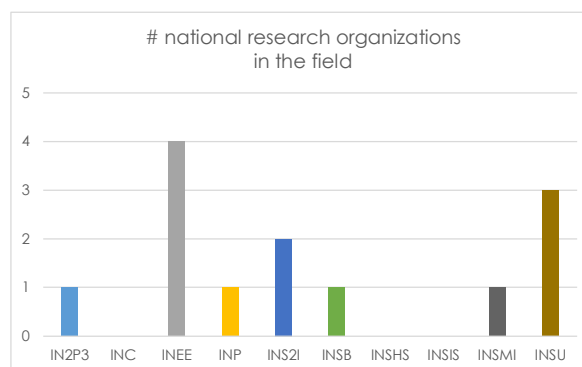
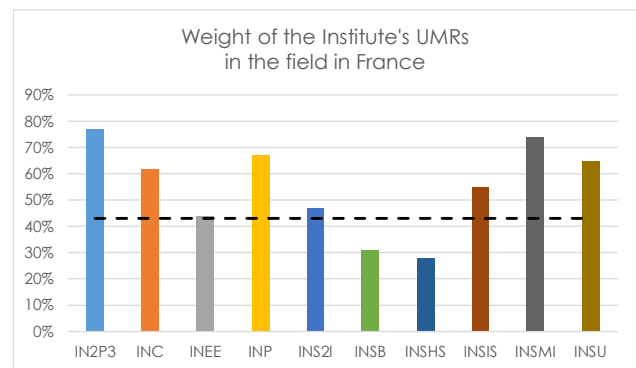
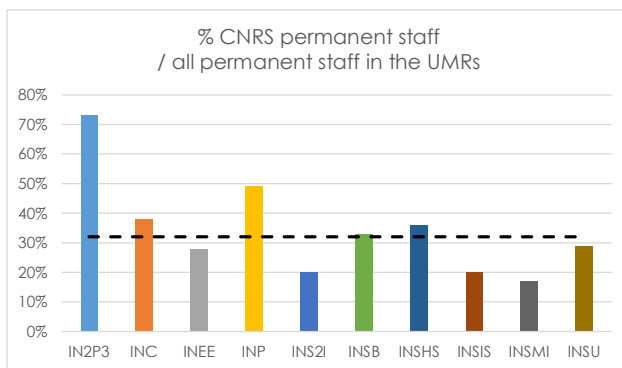
The histograms below illustrate the values of the key indicators. The dashed line on each histogram represents the average value for all ten Institutes.

- Staff

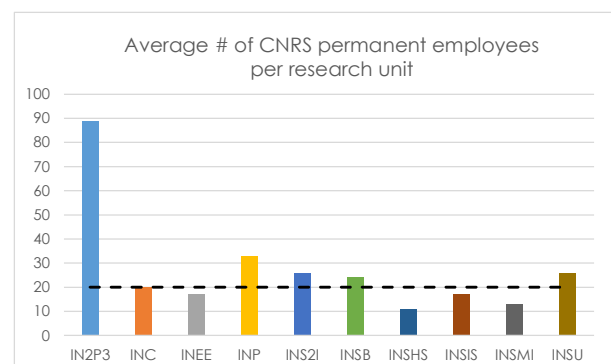
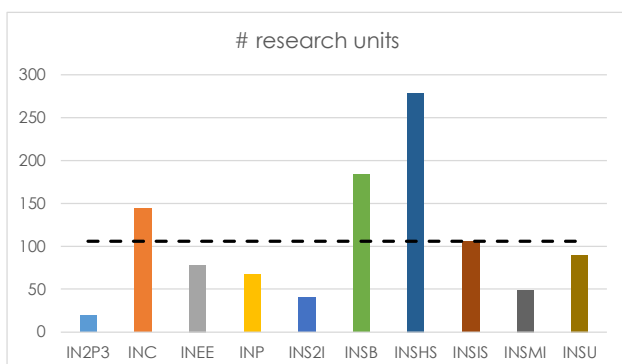




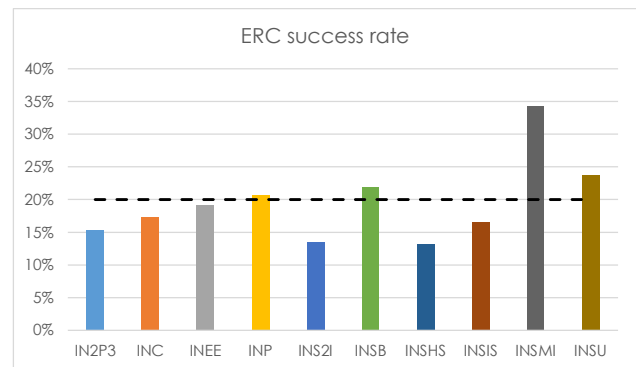
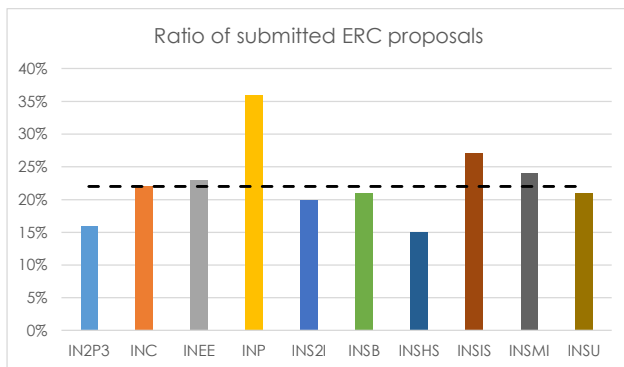
- Weight and position in France



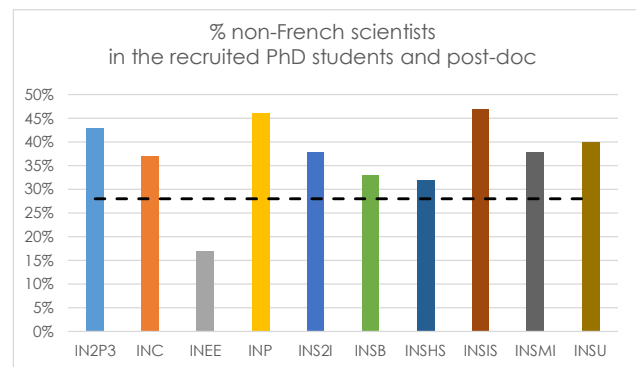
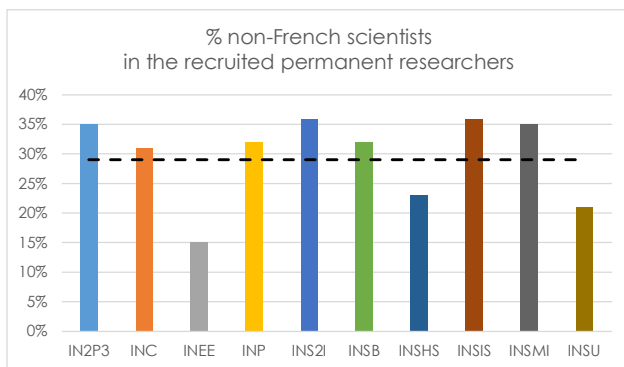
- Research units



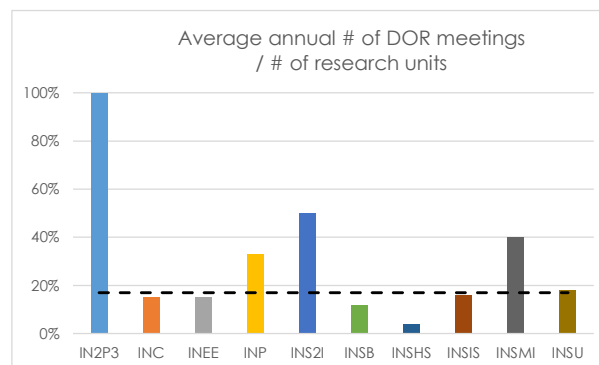
- Participation in ERC



- International recruitment



- DOR meetings



Observations of the chairman and CEO of the CNRS



The Chairman and Chief Executive Officer

Paris, November 8, 2023

Letter of comment

CNRS is delighted that the committee decided to conclude its report with an unambiguous statement: *"The committee considers the CNRS to be a major and world-class research institution. Its history and impact are reflected in its reputation, its size and scope, and its presence throughout France, in European science initiatives, and internationally"*. Particularly attached to its partnerships, both public and private, CNRS also notes with great satisfaction that *"The committee observed that there is considerable pride in being associated with the CNRS brand"*. Quite naturally, and while expressing its confidence in the CNRS, the committee then confronts the CNRS with its responsibilities: *"However, the committee believes that the CNRS can do better"*. Coming from internationally renowned experts, this is a source of inspiration and motivation.

The CNRS warmly thanks the Committee for its involvement and the quality of its work. It had worked upstream with the Hcéres in order to benefit from an exclusively international Committee, or almost (15 of the 16 members do not work in France). This is unique enough to be worth noting, and the CNRS thanks the Hcéres for it. The CNRS sees this as a real opportunity, offering an outside view on its issues. On the other hand, we arguably failed to explain all the "richness" and specific features of the French higher education and research system. In particular, we were unable to dispel the astonishment, and even incomprehension, of some Committee members concerning, for example, public procurement contracts, remuneration or "unités mixtes de recherche" (UMRs).

It should be noted that the Committee was not asked to assess all CNRS activities. The document "Terms of references for the assessment of the CNRS" proposed by the Hcéres, after discussion with the CNRS and the Ministry in charge of research, clearly states *"Focusing the 2022-2023 CNRS assessment means that some of its activities are not accounted for, even though important. This is true in particular for the CNRS policy concerning very large research instruments, for its international collaborations outside Europe, and for most of the topics related to the administrative area or the support functions"*. In hindsight, CNRS regrets having accepted that its international collaborations were not included in the scope of the evaluation. Here again, the feedback of the Committee would have been invaluable.

The report stands out from the usual Hcéres reports for its very direct style and highly operational approach. The CNRS, which had called for a useful report, welcomes this one, which will enrich its thinking. The Committee is careful to point out that *"The committee understands that its views may be challenged, although it hopes that the CNRS will see the opportunities in implementing the recommendations in accordance with its capacity, culture, and ambitions, all to the benefit of its missions and future, and to the benefit of French research and society"*.

The Committee highlights what it considers to be the CNRS's main strengths: *"The scientific production; the pride of belonging; the renown and visibility; the size and scope of the scientific capacities; the leading position in Europe; the enhanced support to technology transfer and innovation; the capacity to build partnerships (e.g. universities, national and international research organizations, industry)"* on which the CNRS should build. The Committee also points out what it considers to be the CNRS's weaknesses, and makes recommendations for limiting or even eliminating them. We'll come back to this later.

The CNRS also sees the committee's report as recognition of the way in which it has for many years been implementing its raison d'être, summed up in the phrase "fundamental research at the service of society". The quality of this fundamental research is a prerequisite for everything else, and CNRS is delighted to read *"The assessment committee is pleased to acknowledge the worldwide first-class recognition of the scientific production of the CNRS"* and *"the committee was pleased to note that the Institutes are vibrant and reflect the dynamism and excellence of CNRS research"*. Finally, the committee took care to highlight the European successes at the European Research Council (ERC), *"This participation is indeed a remarkable success: the CNRS is the top recipient of ERC grants and has a larger number of grants than other large national research institutions (e.g. Max Planck Gesellschaft (MPG) in Germany), even when an estimate of their size is taken into account"*. These results make a major contribution to the reputation of French research.

Within and towards society, CNRS has identified three main "targets": major societal challenges, the socio-economic world and aid for understanding and decision-making. The first is highlighted by the Committee

"considers that the choice made in the COP to put a strong emphasis on 'societal challenges' is to be welcomed". As for the second, the Committee was convinced by the actions of CNRS, stating: *"There is evidence of significant progress in engagement and relations with the private sector. The efforts made to develop technology transfer through professional support, skills, and accessible staff, are commendable"*. On the third, the CNRS devotes already a great deal of time and energy to this, but the committee felt that this was not yet enough, and encouraged it to intensify its efforts: *"The committee considers that the CNRS should strengthen its contribution to the development of a well-educated society through the dissemination of knowledge, and increase the level of its communication both with the public at large and with the government"*.

Finally, the committee emphasizes the CNRS's very special position in the French system: *"The CNRS plays a key role in the French research and higher education ecosystem. It is in a unique position to play a leading role in French research"*. This position confers above all duties, such as supporting universities. The committee thus specifies *"Since the 1960', the CNRS has had a critical and positive influence on the research performed at the universities and grandes écoles"*.

But the main richness and interest of this report does not lie in the compliments, even though these are important, particularly for all the staff who contribute daily to the activities - and successes - of the CNRS. The Committee is convinced that, as already written, the CNRS *"can do better"* by making a dozen recommendations, aimed at addressing the weaknesses the Committee has identified: *"The governance of the CNRS and the modes of co-operation with partners (e.g. universities, national and international research organizations, industry); the approach to developing the talent pool: scientists, engineers, technical and administrative staff; the capacity to measure scientific and societal impact; the mid- and long-term strategies (e.g. science, Europe, funding, etc.); the administrative burden on scientists and engineers; the contributions to a well-educated society"*. These 12 recommendations are briefly commented on below, without repeating all the sub-recommendations in detail. Each recommendation will be the subject of a detailed appraisal involving all potentially concerned stakeholders, both internal and external.

- **Recommendation 1: Update the role and positioning of the CNRS within the evolving French research ecosystem**

For lack of time, it was not possible to explain in detail to the Committee the many changes that have taken place in the French higher education and research system over the last twenty years. Moreover, this was not the aim of the evaluation of the CNRS. In particular, because of the period under review, the most recent developments that are destined to structure our ecosystem (university innovation clusters, Gillet's report, creation of program agencies, etc.), and therefore the place and role of CNRS within it, were not presented to the Committee.

However, the Committee considers that there is still work to be done. While the CNRS naturally has a duty to make proposals on this subject, and regularly does so, this recommendation needs to be discussed with all stakeholders. With this in mind, the report states: *"The committee recommends that the ministry set up a task force with representatives from national research institutions, universities and grandes écoles to build the bases for these clarifications and improvements"*.

- **Recommendation 2: Modernize the governance of the CNRS and bring it to the level of other world-class research institutions**

The Committee was visibly surprised to discover the prerogatives and actual role of the CNRS Board of Directors. Established by law and decree, they are binding on CNRS. It is true that they are not of the same nature as those of the Board of Directors of most foreign universities or institutions.

A particularly sensitive subject, the recommendations to *"Create a standing external advisory board"* and *"Create for each Institute a specific domain-related external strategic advisory board"*, in both cases *"with a high proportion of members from abroad"* will have to be discussed with the scientific communities and social partners. They are complementary to the proposal to *"Redefine and clarify the role of the Scientific Board"*, a subject on which the CNRS has already made concrete proposals, but which requires a change in the decree.

- **Recommendation 3: Deploy new strategies for sustained multiannual diversified funding**

The CNRS is delighted with this recommendation, and will do everything in its power to make it a reality.

Concerning the subsidy for public service, which represents 3/4 of its budget, the CNRS fully adheres to the long warning formulated by the Committee *"This evolution of the budget reveals substantial hardship, and a lack of financial sustainability. This issue should be a major topic in the discussion between the CNRS and the ministry in charge of research regarding the development of the next COP for the 2024-2028 period. The committee considers that national-government funding has to be in line with the mission and position of the CNRS in the French research ecosystem. It also strongly recommends that multi-year public funding be*

committed by the government within the COP, to give the CNRS visibility on the evolution of its national-government subsidy".

With regard to own resources, the CNRS's 2019-2023 Contract of Objectives and Performance (COP) has as its indicators the "Annual amount of research contracts with companies" and the "Amount of revenue from the European Commission" with, for each of them, an ambitious target of a 25% increase over the contract period.

In any case, the CNRS considers that an annual budget divided into "3/4 for the subsidy for public service charges and 1/4 for own resources" is a balance point from which we shouldn't stray too far.

– ***Recommendation 4: Implement an ambitious strategy to attract, support and retain the best talent***

As the CNRS wrote in its self-assessment report and regularly reminds us, "... research is first and foremost the work of talented men and women. Recruiting them, supporting them and retaining them is a major challenge for a research organization, in an increasingly competitive national and international context,..."

It is therefore particularly pleased that the Committee recalls that ***"The excellence of CNRS research depends on its continued capacity to recruit, promote and retain the best talent at all levels, within a context of a highly competitive international research environment. This objective requires the development of a strong policy to support the careers of all permanent staff, and a specific strong policy to support young researchers"***.

The CNRS hopes that the Committee's warning ***"The continued deterioration of competitive compensation levels for engineers, technical, administrative, and research staff poses a risk to maintaining the level of excellence of CNRS"*** will be heeded. Here again, the CNRS is fully in tune with this message, which it repeats tirelessly.

CNRS also welcomes the Committee's invitation to make a special effort for young researchers, who are ***"critical to the renewal of the CNRS"***, by offering them ***"attractive welcome packages"*** and developing a ***"strong policy to support and promote them"***. The CNRS has made a start, but is fully aware that much more needs to be done, especially by international standards.

The CNRS also endorses the sub-recommendation to ***"Make sure that the individual assessment of researchers recognizes and values all their activities in the framework of their missions"***. It has begun to work in this direction, as the Committee noted, ***"the work undertaken by the CNRS towards more qualitative evaluation should continue to be pursued"***.

– ***Recommendation 5: Develop a culture of mentoring and inclusion at all levels***

The CNRS has already launched a number of initiatives: the systematic appointment of a sponsor for newly recruited researchers; a training plan has been implementing for many years, which concerns all employees; researchers are assessed with a frequency set by texts that do not fall within the remit of the CNRS; for over 10 years, a post-evaluation follow-up system for researchers in professional difficulty, involving all the players concerned and producing results; in all institutes career support systems for male and female researchers, with individual interviews.

The CNRS has also implemented a very proactive policy aimed at making the careers of female researchers comparable to those of male researchers, which was not the case until recently.

Last but not least, the CNRS has a comprehensive whistle-blowing system, with a mediator, a compliance officer, a scientific integrity officer (head of a mission of the same name) and a whistle-blowing unit.

Generally speaking, the quality of CNRS Human Resources practices has been recognized by the renewal of the HRS4R label awarded by the European Commission.

However, his recommendation encourages the CNRS to do more and better. The CNRS is convinced that there is room for improvement in terms of individual support for staff members. International benchmarking should help to implement the important sub-recommendation to ***"Start an ambitious work-family balance program, including a significant increase in daycare facilities that are accessible to researchers"***. The culture of the CNRS, and more generally that of the French civil service, is insufficient in this area.

– ***Recommendation 6: Deepen the partnership with universities, strengthen the co-management of the UMRs and the involvement of CNRS researchers in education***

The UMR, a totally atypical organization on the international scene, was the subject of numerous exchanges and questions with the Committee, and seems to have remained a source of astonishment and incomprehension for many of its members. Dialogues Objectives-Resources should be generalized. They are a means of implementing the sub-recommendation, to which the CNRS fully subscribes, inviting it to ***"Together with the universities and other home institutions of the UMRs, establish a clear shared governance system for the UMR"***. The CNRS would also be delighted to give unit directors greater room for maneuver, by providing them with greater basic support. In this respect, the Committee's remark ***"...the balance between ANR funding and operators' funding"***

for performing research in laboratories is a key question that deserves enhanced attention from the ministry" seems particularly worthy of attention.

The Committee invites CNRS to **"Pursue efforts towards building broader - inter-Institute - long term partnerships with some of the large French research universities, including leaving leadership to them on specific topics"**. It should be noted that, apart from the special case of universities specializing in Humanities and Social Sciences, CNRS partnerships most often involve several institutes. This is particularly true for those within Idex and iSites. CNRS would not consider it appropriate to limit its partnerships to "major research universities". CNRS must support excellence wherever it is found, as it has always done. However, for many years now, CNRS has been working to strengthen its differentiated partnerships. The distribution of CNRS permanent staff across different sites is a perfect illustration of this policy.

The CNRS is committed to developing real site policies, involving all stakeholders, and is delighted that **"The committee also endorses a proposition given in the SAR that the ministry should use genuine 'site' indicators in relation with common objectives of, say, the CNRS and a university"**. CNRS is convinced that such indicators would help to define and achieve common global targets.

- **Recommendation 7: Launch a "commando operation" to respond urgently and decisively to the need to simplify administrative processes and reduce the bureaucratic burden on the CNRS community**

Contrary to what appears to have been the Committee's perception (**"Moreover, CNRS upper management seems not to fully appreciate the deep level of frustration across the system"**), the CNRS upper management is fully aware of the level of this frustration among staff with a globally over-complex administrative system.

There is a consensus in the French higher education and research sphere that **"The administrative burden is too heavy at all levels"**, as the Committee notes. A distinction needs to be made here between what is dependent on CNRS and what is imposed on it. Public administrative establishments (CNRS, universities, etc.) are subject in particular to the civil service statute, the public procurement code, the rules of public budgetary and accounting management, and more generally to all public law. They are also subject to the rules governing the justification of expenditure set by each funding body, rules which are not currently coordinated.

The issue of too heavy administrative burden is a real one, and affects all establishments. When given the choice, many units prefer to be managed by CNRS rather than by their university partners. Surveys carried out by the regional delegations show that, despite areas for improvement, satisfaction rates are very high. It's not primarily the CNRS administration that's at fault, even if it also has room for improvement and simplification, on which we are working relentlessly (cf. the continuous improvement approach based on feedback from the field, or the simplification plan currently underway).

On this point, as on many others, the CNRS must set an example. Even if the wording **"commando operation"** is debatable, as no internal commando has the power to change the rules of the civil service or public budget and accounting management, it does reflect the urgency with which we agree. Following Gillet's recent report commissioned by the French Minister for Higher Education and Research, we are currently looking at some fifteen sites to simplify administrative procedures. This is a first step. The CNRS is committed to pursuing this work in a proactive manner, in particular by subscribing to the Committee's sub-recommendation to **"Build appropriate indicators to regularly measure the evolution of the administrative burden on researchers"**. Such indicators would make it possible to objectify the situation and check that we are making progress.

In addition, the question of compensation for support function staff is a central one, especially since, for budgetary reasons, the bonus system in force at CNRS is far from being the best value for money.

- **Recommendation 8: Strengthen the scientific policy and the partnership strategy, as well as risk taking, and implement regular international expert reviews and benchmarking**

Presenting the scientific policy of an institution the size of the CNRS, and working across the entire scientific spectrum, is no easy task. Clearly, we haven't succeeded completely, since the Committee has invited us to **"Develop a better-defined scientific policy"**. At both global and institute level, the CNRS will try to be clearer, without jeopardizing the delicate alchemy between bottom-up and top-down, a characteristic to which the CNRS is particularly attached.

The CNRS is also pleased that the Committee appreciated its efforts to encourage risk-taking and the regular renewal of its research topics: **"The committee has a positive impression about the numerous mechanisms set up to sustain the emergence of new research themes"**. He understands the sub-recommendation **"Facilitate the emergence of new research themes, particularly those that promote inter- and transdisciplinarity"** as an encouragement to go even further.

The issue of research unit evaluation by international experts is crucial. It should be noted that some UMRs, particularly in the field of biology, have set up Scientific Advisory Boards (SABs) to support their development over several years. The value of these SABs in the current context is obvious, but it is paradoxical to set up, for the same unit, one evaluation by the Hcéres, and another by an SAB of its own. This is undoubtedly a burden for the unit and its staff, at a time when everyone is calling for greater simplification. The CNRS can therefore only endorse the sub-recommendation that CNRS assessments should be both more international, *"The CNRS should ask Hcéres to involve more international experts in the assessment of the UMRs, to ensure not only that the CNRS considers that it meets the highest standards, but also that it is seen to do so by peer institutions"*, and more differentiating, *"The CNRS should also ask Hcéres to pursue its efforts to distinguish, through the assessment of UMRs, between research units or teams whose results are 'world-class', those whose results 'have international recognition', and those that have a 'national reputation' or a 'local reputation'"*. Such assessments will be useful to the units themselves, and also to their supervisory authorities.

CNRS is delighted that the Committee has recognized its very proactive policy in the field of open science, *"Open science is clearly a subject where the CNRS has a strong commitment and momentum, and plays a leading role in France. The on-going transformation should continue to be pursued"*.

Finally, the CNRS found the sub-recommendation *"Create a general framework to assess the overall impact of the CNRS in all aspects of its contributions to society"* particularly interesting and stimulating. The CNRS will be working actively on this subject (including, of course, scientific impact), and will also be approaching members of the Committee to gain a better understanding of how the institutions in which they work, and which are among the most prestigious in the world, deal with this essential but delicate issue. Demonstrating the impact of science to decision-makers and the general public is a major challenge, even if the impact of a discovery can be major decades later, as well all know.

– **Recommendation 9: Accelerate the development of innovation and transfer to society**

This recommendation is perfectly in line with the very proactive policy that CNRS has been pursuing for several years, the impact of which was underlined by the Committee: *"Its achievements are highly valued by some of its industrial partners, and some UMRs have a stellar reputation in terms of transfer to industry. Its potential impact on innovation for the French economy and society is very high"*.

In simple terms, this policy is based on two main levers: the creation of startups and the development of trust-based relationships with industrial partners (within the framework of joint laboratories or research collaboration contracts, for example). For the former, the sub-recommendation *"Take responsibility to maximize the access to risk capital and seed funding for startups, including the organization of nationwide awareness initiatives, accelerator activities and exchange of best practices; create focused and effective partnerships to achieve these objectives"* is fully in line with what CNRS is doing through its RISE (methodological support for entrepreneurship), RISE+ (partnership agreements with 6 startup studios to date) and RISE UP (national coordination of the network of research-based companies) initiatives, which facilitate the creation and development of *deeptech* startups from UMRs. For the latter, the sub-recommendation *"Develop a central strategy for collaboration with companies leading to a set of new strategic joint laboratories in France and abroad"* is an invitation to pursue this policy. CNRS currently has over 230 joint laboratories in operation, with the creation of around 30 new joint laboratories per year. For each of its most strategic partners, CNRS has between 5 and 10 active joint labs. It is also convinced of the importance of increasing the number of joint labs with mid-caps and MSMEs, for whom a link with cutting-edge research is often vital.

Finally, CNRS will pay particular attention to the sub-recommendation concerning social innovation: *"Further strengthen the role of the CNRS in social innovation processes such as nature-based solutions, community-based adaptation and resilience, communities of learning and other non-industrial paths to innovation"*. It is part of a process of reflection that CNRS has recently begun, and which is encouraging it to move faster and further.

– **Recommendation 10: Act as a driving force and source of proposals at the European level**

Once again, the Committee attests to the CNRS's exceptional position on the national and international scenes, by giving it a sense of responsibility: *"the CNRS is in a unique position to propose ambitious programs that contribute to the success and influence of European science and innovation"*. Brussels lobbying is not an exercise in which the CNRS excels. The development of its Brussels office is helping it to understand the best ways of lobbying, and its scientific benefits. As example, the dissemination of its roadmap for open science has opened many doors for the CNRS, and enabled it to defend its ideas. It's also clear that the CNRS's weight and success in framework programs mean that it is listened to attentively. The CNRS is nevertheless aware that it needs to do more, and the preparation of the next 10^{ème} European framework program should enable it to implement this recommendation.

The CNRS also intends to draw on the European G6 network, which brings together the six main European research performing organizations (RPO), the CNR in Italy, the CNRS, the CSIC in Spain, the Helmholtz association, the Leibniz association and the Max Planck Gesellschaft (MPG) in Germany, to work on the sub-recommendation **"Bring together European scientific expertise to define ambitious and disruptive initiatives in original and innovative fields, in all areas and at their interface, in partnership with the best European institutions"**. The G6 also recently produced a joint position paper on the next framework program.

– **Recommendation 11: Encourage a culture of sustainability, integrity and responsible research**

This recommendation covers a number of complementary but different topics, which need to be addressed with distinct approaches.

With regard to ethics and integrity, CNRS will pursue its policy of raising awareness, training and sanctioning offenders, in line with the sub-recommendation **"Raise awareness at all levels about ethical issues in research and technology"**. It will continue to rely on the remarkable work of the CNRS Ethics Committee (COMETS) to conduct responsible research, calling on it as and when necessary, as it did recently with regard to the public commitment of researchers.

CNRS believes it has already largely implemented the important sub-recommendation on major social challenges: **"Further strengthen research in areas of national and international concern such as climate change, biodiversity decline and AI safety"**. This is precisely the spirit behind the six major challenges of the CNRS's 2019-2023 Contract of Objectives and Performance: climate change, energy transition, health and the environment, territories of the future, educational inequalities and artificial intelligence. But the CNRS will of course continue its efforts, by continuing to include in its programs the human and social sciences, which appear to it to be essential on all these subjects.

Finally, the CNRS is fully aware of its responsibility as an organization and of the fact that it must strive to be exemplary, which the Committee encourages it to do: **"Strengthen efforts towards adapting the CNRS organization and operations towards sustainability, including making sure that the CNRS itself is setting a good example, so that its message will be stronger"**.

– **Recommendation 12: Enhance knowledge sharing and communication for the benefit of society**

The CNRS felt that it spent a lot of time, energy and money communicating with the general public and decision-makers. It takes note of the Committee's recommendation to do even more.

As far as decision-makers are concerned, the CNRS will be relying in particular on the recently created "Mission pour l'expertise scientifique" (MPES) which the Committee clearly appreciated: **"It appears to be a nimble, agile initiative, able to respond to emerging problems directly relevant to policy"**, and on its "Public Affairs" division.

As the Committee suggests, helping people to understand and make decisions undoubtedly involves **"strengthening the CNRS presence in non-specialist media"** and **"enhancing communication channels and interactions with the general public and civil society"**. This is a long-term task, but one that is essential if we are convinced - as the CNRS is, and as the Committee seems to be - that the **"development of a well-educated society"** is the key to safeguarding our planet and our civilizations.

In conclusion, the CNRS would like to thank the Committee once again for the quality of the work carried out, the atmosphere in which the interviews took place and the many recommendations made in this report.

Some **"may be challenged"**, as the Committee said, and others are not really, or not entirely, the responsibility of the CNRS itself. CNRS will now work on all these issues. They will help the CNRS, **"widely recognized as a major player in European and world research"**, to perform even better in the future and to **"achieve its full potential, for the benefit of the French and global scientific community and society as a whole"**. It's a motivating program that the CNRS will be tackling in the years to come.



Antoine Petit

Members of the assessment committee

Martin Vetterli, chair of the assessment committee

President of the École Polytechnique Fédérale de Lausanne (EPFL, Switzerland).

After completing his PhD at EPFL in 1986, Martin Vetterli taught electrical engineering in the Engineering department at Columbia University. In 1993, he joined the University of California Berkeley as a professor in the department of electrical engineering and computer science. In 1995, he was appointed professor at EPFL where, among other things, he was responsible for the field of communication systems and headed the audio-visual communication laboratory.

Vice-president of EPFL from 2004 to 2011, he became dean of the School of computer and communication sciences in 2011. At the same time, he also taught at the Swiss federal institute of technology in Zurich (ETHZ) and at Stanford University. From 2013 to 2016, he chaired the National research Council of the Swiss National Science Foundation. He has been president of EPFL since 2017.

His research activity concerns several areas in electrical engineering, computer science and applied mathematics. His work covers several fields including wavelet theory and applications, image and video compression, fast algorithms and self-organized communication systems. He is the author of about fifty patents, which have led to the creation of several startups and to technology transfers to companies. He has been awarded numerous national and international awards.

Sophie D'Amours, vice-chair of the assessment committee

Rector of Université Laval (Quebec, Canada).

After her PhD in applied mathematics, Sophie D'Amours joined *Université Laval* in 1995, as a professor in the department of mechanical engineering. Her research works concern business engineering, supply chain management and decision processes. She has held three research chairs, including two Canada research chairs. In *Université Laval*, she was appointed as vice-dean for development and research in the Faculty of science and engineering (2011-2012), and then vice-rector for research (2012-2015). She has been rector of *Université Laval* since 2017.

She founded and headed the research consortium Forac, which brings together the R&D leaders of the Canadian forestry industry (2002-2011) and provided the scientific leadership of a Canadian research strategic network. She is a member of the Engineering Academy of Canada, of the Order of engineers of Quebec, and of the Royal Academy of agriculture and forestry in Sweden.

Michael Bronstein

DeepMind professor of artificial intelligence, University of Oxford (UK).

Michael Bronstein received his PhD from the Technion in 2007. In 2010, he joined the University of Lugano (Switzerland) as a professor at the Institute of computational science. In 2018, he was appointed as a professor in the department of computing at Imperial College London. In 2022, he joined the University of Oxford. He has held visiting appointments at Stanford, MIT and Harvard, and has been affiliated with three Institutes for advanced studies: at the *Technische Universität München* as a Rudolf Diesel fellow (2017-2019), at Harvard as a Radcliffe fellow (2017-2018), and at Princeton (2020). He has been awarded five ERC grants and has received several international awards. He is a member of the *Academia Europaea*.

In addition to his academic career, Michael Bronstein has a serial entrepreneurial activity. He has founded multiple startup companies, including Novafora, Invision (acquired by Intel in 2012), Videocites, and Fabula AI (acquired by Twitter in 2019).

Lorraine Daston

Director emerita, Max Planck Institute for the history of science (Berlin, Germany), and Committee on social thought, University of Chicago (USA).

Lorraine Daston received her PhD in the history of science from Harvard University in 1979. She has taught at Harvard, Princeton, Brandeis, Göttingen and Chicago. Since 1995, she has been director at the Max Planck Institute for the history of science in Berlin. She is also a regular visiting professor at the University of Chicago and a permanent fellow at the *Wissenschaftskolleg zu Berlin*. Her work spans a broad range of topics in the early modern and modern history of science, including probability and statistics, wonders and the order of nature, scientific images, objectivity and other epistemic virtues, quantification, observation, algorithms, and the moral authority of nature. The theme that unites all of her work is the history of rationality, both its ideals and practices.

She is a fellow of the American Academy of arts and sciences, a member of the Berlin-Brandenburg Academy of sciences, and a corresponding member of the British Academy. Her work won her numerous national and international awards.

Jo De Boeck

Executive vice-president and chief strategy officer, Imec (Leuven, Belgium).

Jo De Boeck obtained his PhD in 1991 at the University (KU) of Leuven (Belgium) and joined Imec, an inter-university research institute in microelectronics and nanotechnology created in 1984. He was a NATO fellow at Bellcore in the USA (1991-1992), and a visiting researcher at the Joint research center for atom technology in Japan (1998). In his research career, he has led activities on integration of novel materials at device level and new functionalities at systems level. In 2003, he became vice-president of Imec in charge of the Microsystems division, and in 2005 he started the Holst Center (Eindhoven), a joint open innovation initiative between Imec and TNO. From 2010, he headed the Smart systems and energy technology business unit of Imec. He is a part-time professor at the Engineering department of the KU Leuven, and a visiting professor at the TU Delft in the Netherlands. He was appointed chief technology officer of Imec in 2011 and chief strategy officer in 2018. He is responsible for steering Imec's investment portfolio in R&D, innovation and spin-offs, and strategic relationships with academic partners.

Sandra Díaz

Professor of ecology, National University of Córdoba and senior member of CONICET (Argentina).

Sandra Díaz obtained her PhD from the National University of Córdoba in 1989. Her research activities focus on plant functional traits and syndromes, their effects on ecosystem properties and their interactions with global change factors. She developed a new methodology to quantify plant biodiversity and was the first to provide a global picture of the functional diversity of vascular plants, covering the whole spectrum of plant form and function. She is involved in interdisciplinary work on how societies value and reconfigure nature. She is a professor of ecology at the National University of Córdoba, a senior member of the Argentine National Research Council, and a visiting professor at the School of geography and the Environment at the University of Oxford. She served as co-chair of the IPBES global assessment on biodiversity and ecosystem services from 2016 to 2019.

She is a member of the Academies of sciences of Argentina, Latin America, France, Norway and USA, and is a foreign fellow of the British Royal Society. Her work was recognized with numerous international awards.

Jérôme Faist

Professor of physics, Swiss Federal institute of technology in Zürich (ETHZ, Switzerland).

Jérôme Faist obtained his PhD in physics at EPFL in 1989. He then worked as a post-doc and finally as a member of the technical staff at IBM Rüschlikon (1989-1991) and at Bell Laboratories (1991-1997), where he played a key role in the first quantum cascade laser (QCL) experiment. This major contribution was recognized by a number of international awards. He was then appointed full professor in the physics institute of the University of Neuchâtel (1997). In 1998, he founded the startup company Alpes Laser to commercialize the QCL for scientific, industrial and medical use. In 2007, he became a professor in the institute for quantum electronics of ETHZ. He contributed to the FIRST-Centre for micro and nanoscience. His research interests broadened from the QCL to circuit-based THz lasers, ultra-strong light-matter coupling as well as QCL optical frequency combs, which his group demonstrated first in 2012. His present interests are the development of high performance QCLs in the mid- and far-infrared and the physics of coherence in inter-subband transitions in the presence of strong magnetic fields. He is a member of the US national Academy of engineering.

Timothy Gowers

Professeur titulaire of the Combinatorics chair at Collège de France, and fellow of the Trinity College, University of Cambridge (UK).

Timothy Gowers obtained his PhD in mathematics at Trinity College, University of Cambridge (UK), in 1990. After his PhD, he was elected to a junior research fellowship at Trinity College. In 1991, he became a lecturer at University College London, and then returned to the University of Cambridge in 1995. He was an invited professor at Princeton between 2000 and 2002. In 2020, he joined the Collège de France in Paris as *professeur titulaire* of the Combinatorics chair, while still holding a part-time position in the Department of pure mathematics and mathematical statistics at the University of Cambridge, where he continues to lecture and to supervise research students.

His early research work was in functional analysis and the structures of the Banach spaces, which he investigated using combinatorial tools. He then broadened his research interests, which combine several branches of mathematics, namely analysis, probability, number theory and combinatorics, among others. He is also recognized for his contributions to the popularization of mathematics, and to "collaborative mathematics" with the online Polymath project.

Sir William Timothy Gowers received many international awards. He won the Fields medal in 1998.

Hervé Guillou

Former chairman and chief executive officer of Naval Group.

After graduating from the *École polytechnique*, the *École nationale supérieure des techniques avancées* and the *Institut national des techniques nucléaires*, Hervé Guillou began his career in the *Direction des constructions navales* and participated, in various positions, in the French nuclear submarine development and launch programs. Between 1993 and 1996, he directed the British-French-Italian program on anti-aircraft frigates Horizon, in London. In 1996, he became deputy CEO of Technicatome, and chairman of Principia (engineering solutions for the naval, offshore and energy fields) and of Technoplus Industries.

In 2003, he joined the EADS group, where he headed the French-German Space transportation business unit in charge of the program of the Ariane launcher and of the program of the ballistic missiles M51, then the Defense and communications systems and later the Cyber security business units. In 2014, he became chairman and CEO of Naval Group, a French industrial group specialized in naval defense.

He is a member of the French Academy of technologies and *Académie de marine*, and non-executive chairman of Exail.

Regine Kahmann

Director emerita, Max Planck Institute for terrestrial microbiology (Marburg, Germany).

Regine Kahmann obtained her PhD in biology from the Free University of Berlin in 1974. She worked at the Cold Spring Harbor Laboratory, the Max Planck Institute for biochemistry, the Max Planck Institute for genetics, the IGF Berlin GmbH and the Ludwig-Maximilian-University in München. Between 2000 and 2019 she was director and head of the department of organismic interactions at the Max Planck Institute for terrestrial microbiology in Marburg, while also serving as a professor of genetics at the Philipps-Universität in Marburg. Her work started out with phage genetics and then shifted to the question how fungi colonize plants and cause disease. This led to new insights into how fungal parasites suppress host immune responses, and modulate plant processes for the pathogen's benefit. More recent work involved the functional analysis of secreted fungal effectors and revealed how a subset of them are taken up by cells of the host plant. Among her many honors, she has won the Leibniz Prize of the German Research Foundation and the Gregor Mendel Medal. She is a member of several German academies and of the Academia Europaea; she is a foreign member of the Royal Society, and an international member of the National Academy of sciences in the United States.

Ilan Marek

Distinguished professor of chemistry, Technion (Israel Institute of technology, Haifa, Israel).

Born in Haifa, Ilan Marek received his PhD in 1988 from the *Université Pierre et Marie Curie* in Paris. After a post-doctorate at the Catholic University of Louvain (Belgium), he joined the CNRS in 1990. In 1997, he was appointed assistant professor at the Technion, where he became a full professor in 2004; he has held the Sir Michael and Lady Sobell academic chair since 2005.

In the field of organic chemistry, his research focuses on the design and development of new stereo- and enantio-selective strategies for the synthesis of complex molecular structures. In particular, he is interested in developing carbon-carbon bond forming processes that allow the creation of multiple stereo-centers from alkynes and alkenes.

His work has received numerous national and international awards. He is a member of the French Academy of sciences (2017), the Israel Academy of sciences and humanities (2019) and the Academia Europaea (2021).

Friederike Otto

Senior lecturer at the Grantham Institute for climate change and the Environment, Imperial College, London (UK).

Friederike Otto is a physicist by training; she received a PhD in philosophy of science from the *Freie Universität Berlin* in 2011. In the same year, she joined the Environmental change Institute at the University of Oxford which she led as director from 2018 to 2021. In 2021, she joined the Grantham Institute for climate change and the Environment, one of Imperial's six hubs for research, innovation and influence on global challenges. Her main research interest is on understanding whether and to what extent extreme weather events (droughts, heat waves and storms) are made more likely or intense due to climate change.

She co-founded and leads the World weather attribution (WWA), an international effort to analyze and communicate the possible influence of climate change on extreme weather events. She is one of the authors of the IPCC's Sixth report published in August 2021, and of the Synthesis report to be published in March 2023. The influence of her work has been featured extensively in numerous articles in global media; she was deemed one of the world's 100 most influential people by Time Magazine in 2021.

Riccardo Pozzo

Professor of philosophy, Tor Vergata University of Rome (Italy).

Graduated from the State University of Milan in 1983, Riccardo Pozzo completed his education in Germany: PhD at the University of Saarland in 1988 and Habilitation at the University of Trier in 1995. In 1996 he was appointed at the Catholic University of America in Washington, D.C. In 2003 he came back to Italy on the chair of the history of philosophy at the University of Verona. From 2009 to 2012 he directed the Institute for the European intellectual lexicon and history of ideas of the National Research Council (CNR) of Italy. From 2012 to 2017, he was head of the department of social sciences, humanities and cultural heritage of the CNR, and he implemented Italy's participation in the European research infrastructures for social and cultural innovation. His research focuses on reflection and inclusion as social processes that shape our understanding of what constitutes cultural innovation, a new category of innovation economics, of which he has indicated dimensions, processes and outcomes, while showing their operationalization in empirical case studies. He is titular member of the *Institut international de philosophie*, ordinary member of the European Academy of sciences and arts, ordinary member of the Pontifical Academy of social sciences, corresponding member of the *Accademia degli agiati di scienze, lettere ed arti*.

Richard Riman

Professor of material sciences and engineering, Rutgers University (USA).

Richard Riman joined Rutgers University's Department of materials science and engineering in 1986 as an assistant professor after earning his PhD at MIT. In his research, he explores engineering principles for synthesizing and processing ceramics and aims to make low-temperature processes that match or improve high-temperature processes for making ceramic materials. Aside from structural materials, his expertise includes electronic-, optical-, and bio-materials. He has received many national and international awards in recognition of his work.

He is the author or co-author of nearly 200 patents. Around the world, Richard Riman has established cooperative agreements with private companies, government laboratories and government agencies. He has founded 5 clean-tech companies to manufacture innovative materials, including Solidia Technologies, RRTC, and Queens Carbon; they focus on green manufacturing methods for construction materials useful for consumer, building, and infrastructure applications.

Chiara Sabatti

Professor of biomedical data science and statistics, Stanford University (USA).

Chiara Sabatti obtained her PhD in statistics at Stanford in 1998, followed by a post-doctoral fellowship in the Genetics department of the Stanford medical school (1998-2000). She then spent 11 years at University of California Los Angeles, as an assistant professor and associate professor in human genetics and statistics. She returned to Stanford in 2015 as an associate professor in health research and policy, and later in biomedical data science and statistics; she became a full professor in 2016. She is a member of Bio-X and of the biomedical informatics training program; she is also associate director of Stanford Data science and of the interdisciplinary major in mathematical and computational science.

Her research work is centered on the development of statistical methods for high-dimensional data mining. This entails both reducing computational barriers and ensuring that the results obtained by sifting through a large number of variables are reliable, reproducible, and robust. Her work is by nature interdisciplinary: she has enjoyed collaborating with neuroscientists, engineers, chemists, psychiatrists, oncologists, and others. Her pioneering work in data sciences and her contributions to biomedical statistics are internationally recognized.

Christopher Stubbs

Professor of physics and astronomy, dean of science, Harvard University (USA).

Christopher Stubbs obtained his PhD in physics from the University of Washington in 1988. He joined the Center for particle astrophysics of the University of California Berkeley (1988-1991), and then became an assistant and later associate professor of physics at the University of California Santa Barbara. He was appointed as professor of physics and astronomy at the University of Washington in 1994. In 2003 he joined the departments of physics and astronomy at Harvard University, where he became the dean of science in the faculty of arts and sciences in 2018.

Christopher Stubbs is an experimental physicist working at the interface between particle physics, cosmology and gravitation. His research interests include experimental tests of the foundations of gravitational physics, searches for dark matter, characterizing the dark energy, and observational cosmology. He was part of one of the two teams that first discovered the dark energy by using supernovae to map out the history of cosmic expansion. He is one of the principal investigators on an ambitious survey that will use hundreds of supernovae to map out the recent expansion history of the Universe. His contributions have been recognized with many national and international awards.

Conduct of the assessment

As described in the Introduction above, the assessment began with several meetings between the CNRS and Hcéres, which made it possible to elaborate the *Terms of reference* for the assessment⁵⁹. The CNRS prepared its self-assessment report between April 2022 and January 2023.

The CNRS had the opportunity to express its expectations concerning the assessment in a meeting with the chairman of the assessment committee in December 2022. The committee had two plenary videoconference meetings ahead of the assessment visit, one in January 2023 and one in April 2023. Also, two members of the committee, including its chairman, had a visit on the site of *Aix-Marseille Université* in March 2023.

The assessment visit took place in Paris between May 8 and May 12, 2023. Its program included 60 interviews or meetings.

- Half of the interviews were held with CNRS "officers":
 - the CEO and chairman of the BoD, with the three deputy CEOs,
 - members of the BoD,
 - the chairwoman of the Scientific Board,
 - several chairpersons of the sections of the National committee for scientific research,
 - several elected staff representatives,
 - and various CNRS officers in charge of the main topics addressed in this report.
- Moreover, a meeting was held with the management team of each of the 10 Institutes.
- About 15 interviews were held with CNRS partners and stakeholders:
 - SGPI (*Secrétariat général pour l'investissement*),
 - ANR (*Agence nationale de la recherche*),
 - other French national organizations,
 - associations of French universities: *France Universités* and *Udice*,
 - industrial partners,
 - startup companies,
 - former officers in charge of European research and innovation programs,
 - European partners of the G6 group.
- Furthermore, the committee visited three sites of major partner research universities in the Paris area, namely *Paris Sciences et Lettres*, *Sorbonne Université*, and *Université Paris-Saclay*. On each site, the visit included:
 - an interview with the university president,
 - the visit of several UMRs,
 - and various meetings with UMR directors, with young researchers and *maîtres de conférences*, with PhD students, with CNRS or university support staff, with actors of the local innovation ecosystem, with the CNRS regional office, etc.

The program of the assessment visit also included several meetings of the committee on its own, to share the main observations and learnings from the interviews and meetings, and to start identifying the key points of the assessment report. The committee then worked on writing the assessment report, which was reviewed with Hcéres and collegially approved by the assessment committee.

The assessment report was then submitted to the CNRS for comments on any factual errors, omissions, misunderstanding, inappropriate wording or ill-founded assertions. Last, the chairman and CEO of the CNRS was asked to write his observation letter, which is inserted in the final version of the assessment report.

The assessment process was supported by the team of the Department of the assessment of national research organizations of Hcéres.

⁵⁹ See <https://bit.ly/2023-terms-of-reference-assessment-CNRS>.

List of acronyms

A

Aéres	Agence d'évaluation de la recherche et de l'enseignement supérieur (predecessor of Hcéres)
AI	Artificial intelligence
ANR	Agence nationale de la recherche (French national research agency)

B

BoD	Board of directors
BRGM	Bureau de recherches géologiques et minières (the French geological survey)

C

CAS	Chinese Academy of sciences
CEA	Commissariat à l'énergie atomique et aux énergies alternatives (Alternative energies and atomic energy commission)
CEO	Chief executive officer
CERN	European organization for nuclear research
Cnes	Centre national d'études spatiales (French national space agency)
CNR	Consiglio nazionale delle ricerche (National research council in Italy)
CNRS	Centre national de la recherche scientifique
CONICET	Consejo nacional de investigaciones científicas y técnicas (National council of scientific and technological research in Argentina)
COP	Contrat d'objectifs et de performance (Objectives and performance contract)
CR	Chargé de recherche
CSIC	Consejo superior de investigaciones científicas (High Council of scientific research in Spain)

D

DOR	Dialogue on objectives and resources
DORA	San Francisco Declaration on research assessment
DR	Directeur de recherche

E

EADS	European aeronautic defense and space company
EIC	European innovation council
EPFL	École polytechnique fédérale de Lausanne (Swiss federal Institute of technology in Lausanne)
EPST	Établissement public à caractère scientifique et technologique
ERC	European research council
ESA	European space agency
ETHZ	Eidgenössische technische Hochschule Zürich (Swiss federal Institute of technology in Zürich)
EU	European Union

F

FAIR data	Findable, accessible, interoperable and reusable data
FFP	Fabrication, falsification, plagiarism
FTE	Full-time equivalent

G

G6 group	Association of the CNR in Italy, the CNRS, the CSIC in Spain and the Helmholtz association, the Leibniz association and the MPG in Germany
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H

H2020	Horizon 2020 (the EU framework program for research and innovation in the 2014-2020 period)
HAL	Hyper articles on line
HCR	Highly-cited researcher
Hcéres	<i>Haut Conseil de l'évaluation de la recherche et de l'enseignement supérieur</i> (High Council for evaluation of research and higher education)
HR	Human resources

I

Ifremer	<i>Institut français de recherche pour l'exploitation de la mer</i> (French research institute for the exploitation of the sea)
IGF	<i>Institut für genbiologische Forschung</i> (Research institute in genetic biology)
Imec	Institute for microelectronics and components
IN2P3	National Institute of nuclear and particle physics (in the CNRS)
INC	Institute of chemistry (in the CNRS)
INEE	Institute of ecology and Environment (in the CNRS)
INP	Institute of physics (in the CNRS)
INRAE	<i>Institut national de recherche pour l'agriculture, l'alimentation et l'environnement</i> (French national research institute for agriculture, food and the Environment)
Inria	<i>Institut national de recherche en sciences et technologies du numérique</i> (French research institute in digital science and technology)
INS2I	Institute for information sciences and their interactions (in the CNRS)
INSB	Institute of biological sciences (in the CNRS)
Inserm	<i>Institut national de la santé et de la recherche médicale</i> (French national institute for health and medical research)
INSHS	Institute for humanities and social sciences (in the CNRS)
INSIS	Institute for engineering and systems sciences (in the CNRS)
INSMI	National Institute for mathematical sciences and their interactions (in the CNRS)
INSU	National Institute for Earth and space sciences (in the CNRS)
IP	Intellectual property
IPBES	Intergovernmental science-policy platform on biodiversity and ecosystem services
IPCC	Intergovernmental panel on climate change
IRD	<i>Institut de recherche pour le développement</i> (French national research institute for sustainable development)

K

KIC	Knowledge and innovation community
KPI	Key performance indicator
KU Leuven	<i>Katholieke Universiteit Leuven</i>

M

MIT	Massachusetts Institute of technology
ML	Machine learning
MNHN	<i>Muséum national d'histoire naturelle</i>
MPES	<i>Mission pour l'expertise scientifique</i>
MPG	<i>Max Planck Gesellschaft</i>

N

NASA	National aeronautics and space administration
NATO	North-Atlantic treaty organization

O

OST	<i>Observatoire des sciences et techniques</i> (a department of Hcéres)
OSU	<i>Observatoire des sciences de l'univers</i>

P

PEPR	Priority research program and equipment
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Q

QCL	Quantum cascade laser
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R

R&D	Research and development
RRTC	Advanced composite materials company

S

SAR	Self-assessment report
SATT	<i>Société d'accélération du transfert de technologie</i>
SB	Scientific Board
SGPI	<i>Secrétariat général pour l'investissement</i>
SMEs	Small and medium enterprises
SRD	Site referent director

T

THz	Tera-Hertz
TNO	Netherlands organization for applied scientific research
TU Delft	Delft University of technology

U

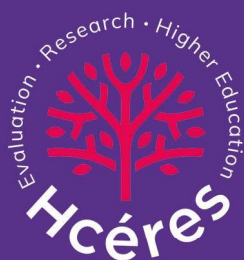
UAR	<i>Unité d'appui et de recherche</i>
Udice	Association of the 10 leading French research-intensive universities
UK	United Kingdom
UMR	<i>Unité mixte de recherche</i>
USA	United States of America

V

VC	Venture capital
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The assessment reports of Hcéres
are available online: www.hceres.fr/en

Assessment of universities and schools
Assessment of research units
Assessment of academic programs
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